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FOURTEENTH ANNUAL REPORT

OF THE

State Board of Health

OF THE

STATE OF OHIO

FOR THE

YEAR ENDING OCTOBER 31, 1899.

FRED. J. HEER, STATE PRINTER
COLUMBUS, OHIO

LETTER OF TRANSMITTAL.

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY,

COLUMBUS, O., *May 23, 1900.*

To His Excellency, GEO. K. NASH, Governor of Ohio:

SIR: — In accordance with Section 8 of an "Act to create and establish a State Board of Health," the accompanying report is herewith submitted for the year ending October 31, 1899.

Respectfully,

C. O. PROBST,

Secretary.

MEMBERS OF THE OHIO STATE BOARD OF HEALTH.

R. D. KAHLE, M. D., Lima.....	December, 1899
JOSIAH HARTZELL, PH. D., <i>President</i> , Canton.....	December, 1900
WM. T. GEMMILL, M. D., <i>Vice President</i> , Forest.....	December, 1901
BYRON STANTON, M. D., Cincinnati.....	December, 1902
J. C. CROSSLAND, M. D., Zanesville.....	December, 1903
WM. T. MILLER, M. D., Cleveland.....	December, 1904
FRANK WARNER, M. D., Columbus.....	December, 1905
C. O. PROBST, M. D., <i>Secretary</i> .	

W. C. Chapman, M. D., Toledo, appointed to succeed Dr. Kahle, term expires
December, 1906.

GENERAL REPORT.

This is the fourteenth annual report of the State Board of Health. It is for the year ending October 31, 1899, except that part of the report dealing with reports of deaths, the investigation of rivers, and the work of the laboratory, which is for the calendar year.

PERSONNEL OF THE BOARD.

The term of office of Dr. Thomas C. Hoover having expired December 13th, 1898, Dr. Frank Warner, of Columbus, was appointed to fill the vacancy so created. Otherwise the personnel of the Board remains unchanged.

MEETINGS.

Six meetings were held during the year; four at Columbus, one at Cincinnati and one at Cleveland.

As usual the meeting in January was held in connection with a meeting of representatives of local boards of health. There was a large attendance and an interesting program. The proceedings are published in full as an appendix to this report.

SMALLPOX.

At the close of the last report, October 31, 1898, smallpox was prevailing in many parts of the state; practically epidemic. The causes for this condition were discussed in that report. The principal cause, undoubtedly, was the failure of the medical profession, in the beginning, to recognize the character of the disease; and this failure was due to the phenomenal symptomatology it has presented, especially its lack of the usual malignancy, less than two percent of the cases having proved fatal. It required considerable time for the profession to convince itself that the prevailing eruptive fever was indeed smallpox. It is unfortunately true that even now, after the disease has been prevailing in Ohio nearly two years, its first appearance in a community is apt to be overlooked, and be mistaken for chicken-pox, or some other affection. However, the diagnosis of smallpox has been accepted by the medical profession at large, and the health authorities have consequently had less difficulty in controlling the disease.

The seeds of smallpox had been too widely cast in during the winter of 1898-9 to expect complete success in blotting out the disease. There were fitful outbreaks during the summer months, easily suppressed, with a considerable augmentation of cases towards the close of the report year (October 31, 1899) presaging a recurrence of epidemic conditions. However, many hundreds of thousands of our citizens, during the past

year, have protected themselves against smallpox by vaccination; physicians have become more or less familiar with the peculiar form of the disease we are having, and we may expect much less difficulty in its prompt recognition. Our health boards have also acquired experience in handling smallpox, all of which leads us to hope that the worst of the epidemic is over.

Following is a list of places where smallpox was reported during the year. The date of the first case reported and the total number of cases occurring in each place is also given:

TABULATED STATEMENT OF SMALLPOX IN OHIO.

CASES AND DEATHS REPORTED TO THE STATE BOARD OF HEALTH FOR THE YEAR, NOVEMBER 1, 1898—OCTOBER 31, 1899.

Locality.	Cases.	Deaths.	First case reported.
Addyston	7	.....	June 20, 1899
Addyston	1	.....	Oct. 14, 1899
Akron	1	.....	Oct. 27, 1899
Amlin	5	.....	Nov. 23, 1898
Avon	2	.....	May 1, 1899
Bainbridge Tp., Geauga Co.	1	.....	Mar. 22, 1899
Bethlehem Tp., Coshocton Co.	2	.....	April 29, 1899
Blanchester	1	.....	Dec. 28, 1898
Bloom Tp., Fairfield Co.	7	.....	Sept 27, 1899
Brooklyn	1	.....	Feb. 21, 1899
Camden	1	.....	April 11, 1899
Cannelsville	1	1	Mar. 11, 1899
Carthage	1	.....	May 7, 1899
Cedarville	4	.....	Oct. 27, 1899
Celina	1	.....	Dec. 14, 1898
Center	3	.....	Nov. 9, 1898
Chagrin Falls	3	.....	Mar. 22, 1899
Cincinnati	443	11	Nov. 30, 1898
Clay Tp., Auglaize Co.	7	.....	Dec. 19, 1898
Cleveland	391	2	Nov. 11, 1898
Cleves	7	.....	Mar. 10, 1899
Clinton Tp., Franklin Co.	6	.....	April 27, 1899
Collinwood	1	.....	May 6, 1899
Columbus	238	4	Feb. 6, 1899
Columbus Grove	1	.....	Nov. 12, 1898
Coshocton	10	.....	Mar. 28, 1899
Cridersville	5	.....	Dec. 5, 1898
Dayton	10	.....	July 20, 1899
Dialton	1	.....	Feb. 10, 1899
Donnelsville	1	.....	Jan. 4, 1899
Empire	1	.....	May 31, 1899
Euclid Tp., Cuyahoga Co.	2	.....	May 1, 1899
Fostoria	2	.....	June 15, 1899
Franklin	5	.....	Jan. 22, 1899
Franklin Tp., Clermont Co.	8	.....	June 22, 1899
Fredericksburg	18	.....	April 3, 1899
Gallipolis	3	.....	Feb. 28, 1899
Girl's Industrial Home.	3	.....	Mar. 19, 1899

TABULATED STATEMENT OF SMALLPOX IN OHIO—Continued.

Locality.	Cases.	Deaths.	First case reported.
Granville	1	.....	April 4, 1899
Green Tp., Gallia Co.....	7	.....	May 15, 1899
Greenfield Tp., Fairfield Co.....	5	1	Sept. 27, 1899
Hamilton	12	.....	Nov. 11, 1898
Hamilton	3	.....	Sept. 24, 1899
Harrison Tp., Perry Co.....	2	.....	Mar. 30, 1899
Higginsport	25	2	June 3, 1899
Howard	2	.....	Mar. 30, 1899
Ironton	6	2	April 29, 1899
Janestown	1	.....	Oct. 27, 1899
Kelleys Island.....	1	.....	May 1, 1899
Killbuck	1	1	April 14, 1899
Lafayette Tp., Coshocton Co.....	8	.....	Jan. 26, 1899
Lancaster	3	.....	Nov. 29, 1898
Lancaster	1	.....	April 17, 1899
Lancaster	27	1	Aug. 19, 1899
Lockland	18	.....	Mar. 11, 1899
Lorain	2	.....	Mar. 4, 1899
Loveland and vicinity.....	75	1	Nov. 7, 1898
Madison Tp., Clark Co.....	2	.....	Dec. 15, 1898
Madisonville	2	.....	May 12, 1899
Mad River Tp., Montgomery Co.....	1	.....	Aug. 10, 1899
Margaretta Tp., Erie Co.....	7	.....	April 12, 1899
Marysville	36	.....	Nov. 21, 1898
Massillon	2	.....	May 29, 1899
Mayfield Tp., Cuyahoga Co.....	1	.....	May 25, 1899
Middlefield	1	.....	Jan. 9, 1899
Mill Creek Tp., Union Co.....	14	.....	April 27, 1899
Millersburg	7	1	April 17, 1899
Mineral Point	1	.....	Dec. 9, 1898
Montgomery Co. Children's Home.....	25	.....	Sept. 11, 1899
Newark	1	.....	Dec. 21, 1898
Newburgh	1	.....	Oct. 12, 1899
Newburgh Tp., Cuyahoga Co.....	1	.....	April 20, 1899
New Carlisle and vicinity.....	66	1	Nov. 15, 1898
New Carlisle	1	.....	Oct. 12, 1899
New Hampshire.....	5	.....	Dec. 20, 1898
New London Tp., Huron Co.....	5	.....	Oct. 19, 1899
Newton Tp., Muskingum Co.....	21	1	Mar. 18, 1899
Noble Tp., Auglaize Co.....	1	.....	Dec. 3, 1898
Painesville	1	.....	Mar. 15, 1899
Parma Tp., Cuyahoga Co.....	1	.....	Mar. 8, 1899
Perry Tp., Franklin Co.....	1	.....	June 11, 1899
Pike Tp., Madison Co.....	2	.....	April 12, 1899
Plain City	1	.....	Mar. 30, 1899
Pleasant Hill	2	.....	June 3, 1899
Pleasantville	1	.....	Mar. 20, 1899
Prairie Tp., Franklin Co.....	1	.....	Oct. 18, 1899
Proctorville	34	.....	June 8, 1899
Radnor Tp., Delaware Co.....	1	.....	April 20, 1899
Ridgeville Tp., Lorain Co.....	2	.....	May 9, 1899
Ripley	4	.....	Nov. 29, 1898
Rochester	1	.....	Oct. 24, 1899
Roseville	1	.....	Mar. 16, 1899
Salt Creek Tp., Holmes Co.....	9	.....	April 14, 1899
Sand Hill	8	.....	Mar. 3, 1899
Sandusky	113	.....	Sept. 22, 1899
Shenandoah	1	.....	Feb. 21, 1899

TABULATED STATEMENT OF SMALLPOX IN OHIO—Concluded.

Locality.	Cases.	Deaths.	First case reported.
South Charleston.....	2	.....	Feb. 13, 1899
Springfield	1	.....	Feb. 28, 1899
Springfield	8	.....	Oct. 3, 1899
Springfield Tp., Clark Co.....	22	.....	Mar. 17, 1899
Stokes Tp., Logan Co.....	9	.....	Nov. 16, 1898
Sunbury	4	.....	Feb. 19, 1899
Tippecanoe	1	.....	Mar. 29, 1899
Thorn Tp., Perry Co.....	1	.....	April 27, 1899
Toledo	2	.....	Feb. 14, 1899
Toledo	4	.....	April 28, 1899
Union Tp., Brown Co.....	1	.....	April 30, 1899
Upper Tp., Lawrence Co.....	1	.....	June 13, 1899
Van Buren Tp., Putnam Co.....	2	.....	Dec. 17, 1898
Washington Tp., Auglaize Co.....	2	.....	Dec. 21, 1898
Washington Tp., Hocking Co.....	1	.....	Oct. 8, 1899
Washington Tp., Clermont Co.....	7	.....	May 7, 1899
Wellington	1	.....	Feb. 14, 1899
West Farmington	1	.....	Mar. 28, 1899
West Jefferson	6	.....	Mar. 8, 1899
Willoughby	1	.....	Feb. 24, 1899
Wyoming	21	.....	Nov. 23, 1898
Xenia	3	.....	Mar. 1, 1899
Xenia Tp., Greene Co.....	2	.....	Sept. 19, 1899
Yellow Springs	1	.....	Dec. 11, 1898
Youngstown	1	.....	Oct. 14, 1899
Zanesville	1	.....	April 4, 1899
Total	1,896	29	

This remarkable epidemic of smallpox has invaded nearly all of the United States, and has extended into Canada. With practically no exceptions it has everywhere preserved the same mild character, the deaths having been less than two per hundred cases.

There has been much speculation as to the cause of this remarkably low death rate. It has not been directly due to vaccination as only a small percent of the patients had been vaccinated. It has been suggested that *indirectly* vaccination has modified the disease, i. e., that a long line of vaccinated ancestors afford even an unvaccinated person some protection against smallpox by modifying the severity of the disease. If this were true we should expect to see this modifying influence most marked in countries where vaccination has been for the longest time, and is still most practiced. Such, however, seems not to be the case.

It has been stated that we are now reaping the benefits of improved sanitary conditions, which have modified this disease. We can hardly suppose that such improved conditions—where they exist—are capable of producing such a *sudden* change in the mortality of smallpox. As late as 1893-4 Chicago, Ills., went through with an epidemic of smallpox

in which the mortality rate was 34 per cent. The sanitary condition of some of the cities where the present mild epidemic has prevailed is probably no better than was that of Chicago in 1894.

The theory most prevalent among the people, and taken up to some extent by the medical profession, is that the disease was introduced into the United States from Cuba by returning soldiers, and that they brought with them the *kind* of smallpox which prevails, or which is said to prevail, in warm countries. Granting for argument that smallpox usually is a mild disease in tropical countries, it can be shown that the present epidemic of the disease began in this country long before our war with Spain began. April 25, 1898, Congress passed an act declaring that war had existed since April 21st. The call for volunteers was issued April 23rd. Shafter's army, the first to invade Cuba, landed June 20-22, 1898. The Ohio epidemic began April 6th, 1898, and had gathered considerable headway before June of that year. The annual report of the Supervising Surgeon General of the M. H. S. for the fiscal year 1898, on page 628, reports nearly 700 cases of smallpox as having occurred in Alabama between November, 1897, and April, 1898. Many other places in the state reported smallpox, the number not being given. Only four deaths have been reported from the disease in Alabama October 31, 1898. On February 28, 1898, the State Board of Health of Kentucky declared smallpox to be epidemic at Middleboro, in that state. On March 14, 1898, Dr. C. P. Wertenbaker, Passed Assistant Surgeon U. S. M. H. S., on special duty there, reported "Since that time (February 28, 1898) there have been 169 cases and 2 deaths."

Prior to our landing troops in Cuba, smallpox, *and of the prevailing mild type*, was present in a number of places in Alabama, Arkansas, Colorado, Florida, Georgia, Massachusetts, Michigan, Mississippi, New York, North Carolina, Ohio, South Carolina, Tennessee, Virginia and West Virginia. In consideration of these facts, poor Cuba and our boys in blue should be absolved from having had any part in the epidemic of smallpox from which we are still suffering, of which the real cause is the general neglect of vaccination.

While the present epidemic of smallpox has caused but 32 deaths in Ohio, it has greatly interrupted trade relations, and has directly and indirectly created more or less serious financial losses wherever it has appeared. The state will never be free from the danger and losses from smallpox epidemics unless vaccination can be enforced. With but few exceptions the victims of the present epidemic have been the unvaccinated. While for the majority of persons the fullest possible protection against smallpox is only attained by *repeated* vaccinations, a reasonable degree of protection against epidemics of the disease would be given by a provision insuring that all citizens of the state should be vaccinated at least once during their lifetime. The most practical plan seems to be that of some of our states which provide by a general law for the vaccination of all

children who enter school. While boards of education in Ohio may now require school children to be vaccinated, this permission is seldom used until after smallpox has appeared, and this is often too late to prevent a considerable extension of the disease. From this lack of system of compulsory vaccination we always find a considerable number of adults and the greater number of school children unprotected against smallpox, a condition which inevitably leads to periodical outbreaks of smallpox of greater or less magnitude.

The objections to vaccination grow out of the occasional accidents which undeniably occur. Contrasted with the immense benefits of vaccination these infrequent accidents of vaccination are indeed most insignificant. One could as well protest against the use of anaesthetics because death is occasionally caused thereby. Nevertheless every precaution should be taken to avoid all evil results from vaccination, if for no other reason than to remove the principal cause of objection against it. As these bad results are largely due to impure virus, or carelessness in using it, if the state should require compulsory vaccination, as herein recommended, it would seem to be its duty to insure, so far as possible, purity of the virus and its proper use. England's example in this matter, of producing vaccine virus and appointing public vaccinators, might be properly followed.

While the various outbreaks of smallpox of the present year have been, with a few exceptions, promptly suppressed, and the disease has in no instance gotten beyond control, we may confidently expect, on account of the great number of centers of infection, that cases will continue to occur here and there during the coming year, and possibly for a longer period.

THE PREVENTION OF CONSUMPTION.

No subject of preventive medicine is attracting more attention at the present time than that of the prevention of consumption. This frightful plague, which has swept away so many millions, and against whose ravages man has been able to do so little, is now confidently placed among the preventable diseases. On account of the immense army of consumptives who are constantly mingling with the public and because of the impossibility of enforcing the simple but essential regulations to prevent contagion, the sanitarian has been able to but slightly reduce the annual mortality from this disease. Enough has been accomplished to give great encouragement for doing more; and there is reason to hope that the time will come when this great plague will have disappeared as others have done in the past.

Perhaps the greatest boon of modern medicine, not even excepting the discovery of antitoxin, is the firmly established fact that consumption is a *curable* disease. The elder Doctor Flint pointed out years ago that consumption in its nature is a self-limited disease, but that the patient was seldom able to support life long enough for the local disease of the

lungs to cure itself. A better knowledge of how to support life has enabled the medical profession to offer to the consumptive, if he will but present himself early enough, and is able to place himself under prescribed conditions, a very good chance to be cured of his disease. Relying but slightly upon medicine, but providing an abundance of fresh out of door air, a proper amount and quality of food, with intelligent regulation of rest and exercise, the physician has now found the way to cure nearly one-half of the unfortunates who have already contracted this malady.

Another, and most important fact, has been established in the curability of consumption. Until recently it was considered that only specially favored portions of the earth—favorable as regards altitude and climatic conditions—were suitable for the treatment of consumptives by what is called *hospitalization*. This meant that the benefits of such treatment were beyond the reach of the poorer classes, which furnish the great majority of cases of the disease. While it is doubtless true that certain climates are more favorable than others, experience has shown that climate is but a minor factor in the cure of consumption. Many portions of Ohio undoubtedly furnish favorable locations for consumptive hospitals. Furthermore there are many advantages in treating patients near their homes, and especially in a climate in which they must dwell, after having been cured or improved by hospital treatment. It is well known that the majority of those who have been cured of consumption in favored places in Colorado, New Mexico or California, are obliged to remain there if they would escape a recurrent attack of the disease.

To provide hospitals for the treatment of consumption is a potent measure for its prevention, in which the well are selfishly interested. Not only is isolation provided thereby for many who otherwise become dangerous to their families and associates, but such hospitals train those who are sent there to use such precautions as will prevent communication of the disease. Each patient, on returning to his home, becomes an emissary of the state for the dissemination of information on "What to do to prevent Consumption."

Health authorities and sanitarians are powerless alone to deal with this question. The state, and our large municipalities must become actively interested in the matter and furnish the necessary aid if anything of consequence is to be accomplished in the cure and prevention of this everywhere present disease.

Considering the fact that fully 700,000 of those now living in Ohio must inevitably die of consumption or some other form of tuberculosis if the present death rate continues, can a more pressing question come before us than that of making use of every possible means to protect ourselves against the frightful ravages of this terrible disease?

Germany, who has done more than any other country in the hospital treatment of consumption, has shown that fully fifty percent of selected cases can be cured. There is good reason for supposing that equally favorable results might be obtained in this state.

Another phase of this question of providing hospitals for the treatment of consumptives should be considered. A large number of cases among the poor in cities find their way into the general hospitals. Dr. Knopf, in his recent excellent work on "Prevention and Treatment of Pulmonary Tuberculosis" estimates that the average daily per capita cost for all patients treated in the hospitals of New York City is \$1.16. But few of the consumptive patients sent to the general hospital are cured or benefited. For the same sum, \$1.16 per day, it would be possible to maintain tubercular cases in hospitals specially designed to cure this disease, and with the assurance that fully one-half of those sent there early would be returned to their families cured, and with the prospect of their remaining useful citizens for many years at least.

No field of labor offers hopes for better returns than work for the cure and prevention of consumption. Let the fortunate among us, those who have accumulated large fortunes and who feel, as many of them undoubtedly do, a desire to help the unfortunate, come to our aid.

Consumption by preference selects its victims from among the young adult population, a population, in many ways, most worth saving. The expense of their raising and education has been paid. They are now in the best earning period of their lives. In most cases they have married and have children of their own who would, under favorable conditions, become valuable citizens of the state. But the young father, the breadwinner, comes down with consumption, and without help must die. What is to become of the wife and children? Surely philanthropists can find no more profitable investment than the erection of institutions where one-half of the enormous number of consumptives may be cured of their disease and returned to their families.

A number of interests must be united to successfully combat this common enemy, consumption. The state, the municipality, the philanthropist, the physician and the sanitarian should jointly take up this holy war, and continue to battle until this greatest of all plagues has been practically driven from among us.

We would urge upon the General Assembly and the people they represent, that a hospital for the treatment of consumption (pulmonary tuberculosis) be erected by the state and that municipalities be authorized to issue bonds for similar institutions of their own. In regard to admission to the state institution we believe it would be wise in the beginning to follow the plan of the state of Massachusetts, and select, by a rigid examination, only those whose condition warrants the expectation of a cure or permanent benefit.

In Massachusetts a charge of 50 cents per day is made for each patient with the exception of a small number who are allowed admittance free under certain conditions.

For our large cities it would seem to be advisable that hospitals be used largely for the prevention of consumption, patients whose surroundings are most unfavorable as regards danger of *spreading the disease*, being sent there: Also for all cases which now find their way to the general hospital.

In this connection attention should be called to the fact that Cincinnati now has a hospital for consumptives. The following report, based upon information furnished by the physician in charge, Dr. B. F. Lyle, should be of interest:

THE CINCINNATI HOSPITAL FOR CONSUMPTIVES.

The Cincinnati Hospital for the treatment of consumption was established for two purposes—first, to protect persons sent to the general hospital for injury or disease against the danger of associating with persons afflicted with a contagious malady—that is tuberculosis, and in the second place to provide for consumptives requiring hospital treatment, a better opportunity for recovery by removing them to a place where pure air and special treatment could be given them.

The hospital was opened July 8, 1897. The number of persons admitted up to August 30, 1899, was 301. The number of admissions was 330, there having been

Readmitted once	22
Readmitted twice	4
Readmitted thrice	3

The buildings which were originally constructed as a hospital for smallpox patients, are located in the center of a beautiful park of 53 acres, about five miles west of the general hospital, and outside of the city limits. The ground is hilly, and the buildings, which are on the top of a hill, are 415.27 feet above the city, or 846.97 feet above sea level. Gas and water are obtained from the supply for the city.

The building used for the reception of patients is a brick structure 255 feet in length. This is divided into a central or administration building and two wings. The administration building is two stories in height with a basement used as a store room and a large attic that could be converted into a dormitory if necessary. The first floor is used for offices of the physician and superintendent, the kitchen and dining room for servants. The second floor contains the sleeping apartments of the domestics. The wings are of the same size, each being divided into three wards, two on the first floor and one on the second floor. The two large wards are occupied by white male patients, one of the smaller by females and one of corresponding size by colored males.

The two small wards on the second floor have not been used. One hundred feet east of the building just mentioned is a large frame dwelling containing fifteen rooms. Nine of these have been reserved for private patients, the others being occupied by the nurses.

The two large wards are each capable of accommodating 19 patients. They each have 1,841 square feet of floor space, 27,922 cubic feet of air space, and 18 windows with a combined area of 432 square feet. This would allow each

patient 97 square feet floor space, 1,469.5 cubic feet of air space, and about 23 square feet of window space.

There are two small wards each accommodating nine patients. They each contain 910 square feet of floor space, 12,290 cubic feet of air space, and 240 square feet of window space. This allows each patient 100 square feet of floor space, 1,365 cubic feet of air space and 26 2-3 square feet of window space.

There are in addition two upper rooms with four beds in each, and giving to each patient 140 2-3 square feet of floor space, 2,053 cubic feet of air space, and 23.4 square feet of window space.

The total capacity is thus 64 patients, which by crowding can be increased to 88.

A plant for heating the buildings with steam has just been completed. While the buildings are provided with ventilators connected with air shafts, these are not depended upon alone. Every window is raised from the bottom about three inches and a board of corresponding width closes the aperture. This permits the air to enter between the sashes. Besides this the patients unable to leave their beds are treated to the pure atmospheric air for from one to two hours daily, the windows being lowered from the top. Blankets are provided in large numbers so that none are chilled. Patients are encouraged to be outside in all kinds of weather, and warm clothing and shoes are provided them.

As the property was purchased and the buildings erected 20 years ago, it is impossible to determine the cost of the plant. The following is regarded as a fair estimate of its value:

Grounds	\$26,000
Hospital building and steam plant.....	28,000
Nurses' Home	7,000
Improvements	7,000
"Annex" (for smallpox patients).....	6,000
Furnishings	6,000
Total	\$80,000

The management of the hospital in so far as it relates to the welfare of the patients, is in the hands of the visiting physician, Dr. B. F. Lyle. The hospital is a branch of the general hospital, which is managed by a board of trustees, five of whom are appointed by the Governor and the courts. The Mayor and President of the Board of City Affairs being also ex-officio members of the board.

The "branch" hospital staff consists of one physician and four nurses. The head nurse having charge of the culinary department; of two cooks, two ward maids and two men. An extra man is employed in winter to manage the fires at night.

Dr. Lyle writes:

"I think the method by which ours is managed is very satisfactory. The trustees and superintendent endeavor to the best of their ability to provide for the material necessities of the patients, and give every encouragement to the physician and nurses, who on their part endeavor to deserve the confidence reposed in them. By thus possessing mutual confidence in each other all efforts are expended in the production of the desired results. In our institution the physician is in charge of all medical matters in the broader sense, having charge not only of the treatment of the patients, but of their material comforts as well; and as in tuberculosis the quality and preparation of the food and the character of the clothing is of vital importance, this can be the only practical arrangement."

Definite information as to running expenses could not be obtained as the accounts of the "branch" and general hospital are not kept separated. The expenses are nearly as great for 20 as for 50 patients. It is estimated that the per capita cost is about \$1.25 per day.

The monthly cost of medical attendance and nursing is \$140, or \$8.086 per patient a day. No comments are made by the attending physician in furnishing this information, but our readers will be struck with the remarkable economy practiced in this part of the hospital work.

The daily cost of food and clothing is about 35 cents, and all other expenses 80 cents. The superintendent thinks that about \$13,000 was spent for the "branch" hospital last year, divided as follows:

Salaries	\$3,000
Food and clothing.....	7,000
Other expenses	3,000

Arrangements have recently been made for the admission of a few private patients at a cost of \$8.00 per week, if admitted to the general wards, and of from \$14.00 to \$20.00 per week if furnished with a private room.

"All cases of pulmonary tuberculosis are sent to the 'branch hospital,' in fact, no cases are admitted to the wards of the general hospital, an isolation ward having been reserved for their reception until they are sent for. Persons in all stages are received, an effort being made at the branch to separate the advanced cases from those beginning with tuberculosis."

"Bacteriological examinations are made of the sputum only as an assistance in diagnosis. The varying amount of the expectoration discharged daily and its character, together with the fact that the number of bacilli discharged varies greatly at different times, makes it necessary to have a well equipped laboratory and a bacteriologist who can devote a large part of his time to this work if we wish to give sputum examinations the proper attention. Personally I do not think the game is worth the candle. We ought to examine the sputum of all patients who come to us, but we should also be able to make a diagnosis long before the breaking down of the lung admits of the presence of tubercle bacilli in the sputum. I would also much prefer to base my prognosis on the general condition of the patient and the physical signs rather than upon the number of tubercle bacilli in the sputum, although of course the knowledge we thus obtain is not to be regarded with indifference."

"All patients are required to have with them constantly an enameled spit-cup, which is half filled with a 3 per cent. solution of carbolic acid. No handkerchiefs are permitted, but the patients are given squares of gauze which are burned after being used.

"No one has contracted (or developed) tuberculosis at the hospital.

"It is difficult, if not impossible, to tell the effect of medication alone, taking into consideration the character of the patients received and the progress of the disease, in many of them the results have far exceeded our anticipations. Many of our patients who left the hospital 12 or 18 months ago still pursue their ordinary avocations, the time which has elapsed since their discharge is too short to make claims of permanent cures, we can, however, enjoy the knowledge that our efforts have added many days of usefulness and pleasure to those who have been under our care."

In reply to the query: "Number able to resume occupations; number of these still able to work." Dr. Lyle replied: "It is difficult to give a correct answer to this question, as we hear from comparatively few of our patients after they leave. Many we know, who have been out of the hospital for more than a year are still pursuing their customary avocations."

But little labor has been secured from the patients, and no attempt has been made to have them do gardening, etc., on account of the unfavorable character of the soil.

The following tables, showing admissions, discharges and deaths, are of interest:

TABLE I—SHOWING AGE, COLOR, SEX, DURATION OF DISEASE, STAGE OF DISEASE AND SOCIAL CONDITION OF ALL PATIENTS ADMITTED.

Sex.	Ages.						Duration of Disease.						Stage of Disease.			Social Con- dition.	
	To 20 yrs.	Bet. 20-30 yrs.	Bet. 30-40 yrs.	Bet. 40-50 yrs.	50 yrs. and over.	Total.	To 1 year.	1 to 2 years.	2 to 3 years.	3 to 4 years.	4 years.	Total.	First.	Second.	Third.	M.	S.
Males — White ..	7	37	47	44	38	173	85	42	27	9	10	173	29	44	100	50	123
Colored .	6	26	17	12	7	68	32	29	6	1	0	68	11	15	42	17	51
Females — White	12	17	7	6	3	45	22	12	8	2	1	45	11	15	19		
Colored	2	9	4	0	0	15	9	5	1	0	0	15	2	3	10	2	13
Total	27	89	75	62	48	301	148	88	42	12	11	301	53	77	171	84	217

TABLE II—SHOWING AGE, SEX, COLOR AND DURATION OF DISEASE OF PATIENTS WHO DIED.

Sex.	Ages.					Total.	Duration of Disease.					Total.
	To 20 years.	Bet. 20-30 yrs.	Bet. 30-40 yrs.	Bet. 40-50 yrs.	50 yrs. and over.		To 1 year.	1 to 2 years.	2 to 3 years.	3 to 4 years.	4 years.	
Males — White	0	14	17	22	16	69	48	12	8	1	....	69
Colored	3	19	8	9	5	44	30	6	5	3	....	44
Females — White	1	8	5	2	1	17	8	3	3	3	....	17
Colored	4	6	1	0	0	11	7	3	1	0	....	11
Total	8	47	31	33	22	141	93	24	17	7	....	141

TABLE III — SHOWING DURATION OF STAY IN HOSPITAL OF PATIENTS DISCHARGED, DEAD AND REMAINING.

	To 1 month.	1 to 2 mos.	2 to 3 mos.	3 to 4 mos.	4 to 5 mos.	5 to 6 mos.	6 to 9 mos.	9 to 12 mos.	12 to 15 mos.	15 to 18 mos.	18 to 24 mos.	Total.
Discharged improved	16	24	13	6	4	4	8	0	0	2	0	77
Discharged unimproved..	39	9	9	8	2	3	1	5	0	0	2	78
Died	77	30	13	3	3	6	3	2	2	2	0	141
Remaining improved	5	4	3	0	1	0	2	1	0	1	....	17
Remaining unimproved...	8	2	4	0	0	0	1	1	0	1	....	17
												330

TABLE IV — SHOWING INCREASE IN WEIGHT OF PATIENTS. THIS INCLUDES PATIENTS WHO HAVE BEEN READMITTED.

1 to 5 Pounds.	5 to 10 Pounds.	10 to 15 Pounds.	15 to 20 Pounds.	20 to 25 Pounds.	25 to 30 Pounds.	30 to 35 Pounds.
35	43	36	22	6	3	3

TUBERCULOSIS OF ANIMALS.

In considering measures for the prevention of tuberculosis in man attention must be paid to tuberculosis in food producing animals, and especially milch cows. Tuberculosis of animals is undoubtedly of the same nature as tuberculosis of man, and may be communicated from man to animal and from animal to man. The greatest danger comes from the use of milk from cows having the disease. The number of dairy cows in Ohio affected with tuberculosis is unknown, but is certainly large.

In any comprehensive plan adopted by the state for the prevention of tuberculosis there should be included measures for dealing with tuberculosis of animals. We do not believe that it is necessary to slaughter the greater part of animals found to have this disease. By intelligent treatment many of them can be cured. As calves are rarely born with tuberculosis, tuberculous animals may be used for breeding purposes by not allowing the calf to suckle its mother. Others may be fattened for slaughter and sold for food purposes under certain restrictions.

Believing that harmonious action should be secured from all those interested in this question, the Board has arranged to bring this question before the owners of dairy cows by means of lectures to be delivered by persons selected by the Board, at various Farmers' Institutes to be held during the winter of 1899-1900. The Board has received marked assistance in this matter from the Secretary of the State Board of Agriculture. Should success be attended in securing in this way the interest of cattle owners in this subject, it is the intention of the Board to continue these lectures another year.

It is appropriate at this place for the Board to publicly thank, which it most cordially does, those who, without compensation and at their own expense (when the institute is not held at their home), give their services to the state for the purpose outlined above.

The names of these lecturers and the places where lectures are to be given, are as follows:

Dr. O. W. Robe.....	Peebles	Adams county.
" A. R. Rudy.....	Beaver Dam.....	Allen "
" L. F. Laudick.....	Delphos	Allen "
" A. W. Hopkins.....	Ashtabula	Ashtabula "
" S. S. Burrows.....	Geneva	Ashtabula "
" W. S. Rawson.....	Athens	Athens "
" A. H. Hise.....	Carrollton	Carroll "
" O. A. Ninceheler.....	Mechanicsburg	Champaign "
" C. A. Grahn.....	South Charleston.....	Clark "
" Ben Davis.....	New Carlisle.....	Clark "
" W. B. Doan.....	Amelia	Clermont "
" J. L. Fomorin.....	Lerado	Clermont "
" Julius D. Abbott.....	Bethel	Clermont "
" R. T. Trimble.....	Wilmington	Clinton "
" J. E. Foster.....	Keene	Coshocton "
" W. A. Daugherty.....	Bucyrus	Crawford "
" J. F. Fitzsimmons.....	Galion	Crawford "
" L. B. Tuckerman.....	Euclid	Cuyahoga "
" Charles E. Slocum.....	Defiance	Defiance "
" D. E. Hughs.....	Delaware	Delaware "
" M. J. Love.....	Castalia	Erie "
" N. P. Davidson.....	Hilliard	Franklin "
" D. W. Cable.....	Westerville	Franklin "
" J. D. King.....	Groveport	Franklin "
" W. E. Ramsey.....	Delta	Fulton "
" Arch M. Wilkins.....	Wauseon	Fulton "
" B. F. Ray.....	Burton	Geauga "
" H. H. Seys.....	Yellow Springs.....	Greene "
" D. L. Cowden.....	Cambridge	Guernsey "
" D. L. Cowden.....	Quaker City.....	Guernsey "
" W. A. Auby.....	Cleves	Hamilton "
" J. H. Lathrop.....	Deshler	Henry "
" S. R. Howard.....	Hillsboro	Highland "
" N. H. Blosser.....	Logan	Hocking "
" W. E. Williams.....	Jackson	Jackson "

Dr. W. H. Wood.....	Smithfield	Jefferson county.
" Samuel Rothacker.....	Richmond	Jefferson "
" C. R. Bradfield.....	Danville	Knox "
" W. W. Pennell.....	Fredericktown	Knox "
" E. G. Clark.....	Willoughby	Lake "
" E. D. Whitney.....	Painesville	Lake "
" E. E. Wells.....	South Point.....	Lawrence "
" G. W. Garrison.....	Utica	Licking "
" E. J. Barnes.....	Granville	Licking "
" S. S. Richards.....	Jersey	Licking "
" A. H. Logan.....	Bellefontaine	Logan "
" S. S. Cox.....	North Ridgeville.....	Lorain "
" W. C. Chapman.....	Maumee	Lucas "
" H. J. Sharp.....	London	Madison "
" H. E. Welch.....	Berlin Center.....	Mahoning "
" R. C. Fausett.....	North Jackson.....	Mahoning "
" Milo M. Moody.....	Chatham	Medina "
" P. E. Beach.....	Seville	Medina "
" L. P. Lisle.....	Neptune	Mercer "
" Gainor Jennings.....	West Milton.....	Miami "
" V. Z. Miller.....	Brookville	Montgomery county.
" W. H. Riley.....	Vandalia	Montgomery "
" F. C. Griffiths.....	Cardington	Morrow "
" C. W. Morehouse.....	Sparta	Morrow "
" O. O. McKee.....	Summerfield	Noble "
" Paul de la Barre.....	Port Clinton.....	Ottawa "
" J. E. Mulligan.....	Payne	Paulding "
" Louis Dunn.....	New Paris.....	Preble "
" D. W. McQueen.....	Camden	Preble "
" C. E. Beardsley.....	Ottawa	Putnam "
" J. M. McLaughlin.....	Butler	Richland "
" C. A. Kefauver.....	Kingston	Ross "
" C. A. Force.....	Attica	Seneca "
" H. E. Beebe.....	Sidney	Shelby "
" Frank Kahler.....	Marlboro	Stark "
" Frank Kahler.....	Navarre.....	Stark "
" O. A. Dickson.....	Johnsonville	Trumbull "
" O. A. Dickson.....	Vienna	Trumbull "
" Wm. Garrett.....	Zoar	Tuscarawas "
" R. L. Crooks.....	Convoy	Van Wert "
" M. S. Cromer.....	Ohio City.....	Van Wert "
" R. R. Alwood.....	Bryan	Williams "
" W. M. Tuller.....	Bowling Green.....	Wood "

INVESTIGATION OF STREAMS.

The Board has continued the investigation of the streams of Ohio, commenced in 1897. During the present year the Muskingum river and its branches has been under observation.

The investigation, as noted more fully in previous reports, consisted in monthly examinations of the river at all places where it is receiving municipal sewage or other polluting material, or being made use of for a public water supply. The entire watershed was also inspected by the

engineer, who noted the character and amount of the various pollutions entering the stream. A detailed report of the work upon the Muskingum river may be found as an appendix to this report.

LABORATORY.

There were 618 chemical and 694 bacteriological examinations made in the laboratory during the year. Most of these were in connection with the river investigation. A considerable number of wells were examined which were suspected to have caused typhoid fever. The funds available for the expenses of the Laboratory have been small, and this has limited the work. It is hoped that during the coming year greater facilities will be provided so that all requests of local boards of health for laboratory examinations may be granted. A detailed account of the laboratory work may be found on a later page.

WATER SUPPLIES AND SEWERAGE.

Plans for the approval of public water supplies were presented by the following cities, villages and public institutions:

Boys' Industrial School, Lancaster; Jackson, Columbus, Glouster, New Richmond, Pomeroy, Youngstown, Shreve, Cridersville, Berea, Canton, Dennison, Kenton, Troy, Greenville and Conneaut.

The plans were approved except for Glouster.

The following cities, villages and public institutions presented plans for sewerage:

Wellsville, Lorain, Youngstown, storm water relief sewer and sanitary sewer in Market street; Piqua, Lorain (to be constructed by the Sheffield Land and Improvement Company), Niles, Zanesville, South Brooklyn, Lakewood, Findlay, McConnelsville and the State Hospital for Insane at Newburg:

These plans were approved except for Youngstown (a sanitary sewer in Market street), South Brooklyn, Lakewood and Findlay.

In addition the Board acted upon plans for sewage purification for the Ohio Hospital for Epileptics at Gallipolis, Boys' Industrial School, Lancaster; Montgomery County Infirmary, Trumbull County Infirmary and Fairmount Children's Home.

Reports upon these various plans, and the Board's action in each case, may be found on a subsequent page under Water Supplies and Sewerage.

The law under which the Board is acting as regards approving plans for sewerage systems and public water supplies, has now been in operation since March, 1893. During that time 162 municipalities or public institutions have presented plans for sewerage or water supply, or for works to purify sewage or water, which were acted upon by the Board.

The law, which was an amendment to the act establishing the State Board of Health, reads as follows:

"Section 2. * * * and no city, village, corporation or person shall introduce a public water supply or system of sewerage, or change or extend any public water supply or outlet of any system of sewerage now in use, unless the proposed source of such water supply or outlet for such sewerage system shall have been submitted to and received the approval of the State Board of Health. (O. L. vol. 90, p. 94.)"

It will be noted that the Board's action is practically limited to the approval of the outlet of a sewerage system or the source of a water supply. The intent of the act is obviously to protect the people against polluted water for municipal purposes, and also to prevent the creation of injurious nuisances by the overloading of streams with sewage.

It has been realized for some time that the scope of this act should be broadened, and the powers of the Board increased in this direction. It was the part of wisdom, however, to first enforce the present act in a manner to demonstrate the desirability of having a central authority control the action of municipalities and private corporations in such matters. It is confidently believed that this has been done, and that with larger powers as regards water supplies and sewerage, a much greater protection may be given to the public health.

There are numerous cities in the state which are now suffering from the use of polluted water supplies. Each case requires thorough investigation to determine the action that ought to be taken. If the pollution is found to be due to the sewage of some city that is casting its sewage into the stream from which the public water supply is taken, purification of the sewage may be required, or purification of the water supply, or both. In all such cases the state should be able to use its authority to remedy the evils. Some proper court might be authorized, whenever the State Board of Health should show the necessity of it, to order such changes as the Board should declare necessary, and to assess the cost upon one or both communities implicated, as the equity of each case should demand.

The investigation of rivers will be completed by 1901, and it will then be possible to present a report showing the condition of all streams in Ohio, as regards their pollution, and the source and opportunities for contamination of all public water supplies.

LOCAL BOARDS OF HEALTH.

Every effort has been made to keep up the local health organizations. This has been difficult in many of the villages, and, in some of them, impossible. There is the feeling on the part of the council, in some of the villages, that the board of health is a useless expense. The council frequently refuses to pay the bills of the board of health. Often they fail to fill vacancies on the board, occurring by the expiration of

terms of office of members, so that it is sometimes difficult to know whether a certain board has a legal existence.

It would perhaps be wise that the appointment of a board of health in villages should be optional with council, provided it is required that a health officer must be appointed. The State Board of Health should then be empowered to appoint a health officer in all villages which, after notification, fail to make such an appointment.

The Municipal Code Bill, which is to be presented to the next General Assembly, provides for a number of changes in the health laws, including a change in the manner of organization of such boards. The provisions of the bill for the selection, by competitive examination, of health officers and sanitary policemen, are highly commendable, provided, of course, that the examinations would be fairly conducted, and by persons having a practical knowledge of the requirements of these officers.

The services of the health officer are undoubtedly becoming better appreciated by the public, and the demand for the selection, and the retention in office, of men properly qualified for this responsible position, which must inevitably come, will result, we trust, in properly rewarding a class of public servants who, except in our large cities, are now so poorly paid. The proceedings of the board and its various investigations during the year, may be found under the Secretary's report.

SECRETARY'S REPORT AND MINUTES OF BOARD MEETINGS.

NOVEMBER MEETING.

An adjourned meeting of the State Board of Health was held at the office of the Secretary, at Columbus, November 29th, 1898.

There were present Drs. Kahle, Hoover, Stanton and Miller.

The Secretary presented a report upon the smallpox situation in Ohio, and the steps that had been taken to prevent spread of the disease. He also presented rules and regulations for the prevention of smallpox, and recommended their adoption.

Dr Hoover moved that the rules and regulations be adopted. Dr. Stanton moved to amend by including chickenpox among the diseases to placard, until further notice by the Board.

The motion as amended was adopted.

The rules, as adopted are as follows:

RULES AND REGULATIONS OF THE OHIO STATE BOARD OF HEALTH FOR THE PREVENTION OF SMALL POX.

1. Physicians called to attend persons suffering from small-pox, varioloid (modified small-pox), or chicken-pox, shall report the fact within 12 hours to the board of health within whose jurisdiction such persons are found, giving their names and addresses.

2. When there is good reason to suspect the existence of small-pox in any house or place from a report other than from a physician, it shall be the duty of the board of health to at once make an investigation, by sending a physician to examine and report upon suspected cases.

3. In case of small-pox or varioloid it shall be the duty of the board of health receiving such report to at once placard the house in which the patient resides or is found, announcing in large letters the existence of SMALL-POX WITHIN, which placard shall not be removed until after recovery of the patient and disinfection of the house; or the board may remove the patient to an infectious disease hospital, disinfect the house and contents, and quarantine the inmates who are not protected against small-pox by a previous attack of the disease, or by recent successful vaccination, for 16 days from the completion of such disinfection.

4. In case of chicken-pox it shall be the duty of the board of health to at once placard the house in which the patient resides or is found, announcing in large letters the existence of CONTAGIOUS DISEASE WITHIN, which placard shall not be removed until after recovery of the patient.

5. A quarantine notice shall be served upon the head of the household forbidding any one to enter or leave the premises except the attending physician or other person authorized by the board of health.

6. It shall be the duty of the local board of health to strictly enforce this order, which shall be done by placing a day and night guard over quarantined houses whenever necessary.

7. All persons unprotected against small-pox by a former attack of the disease, or by recent successful vaccination, known to have been exposed to a person suffering from small-pox in the eruptive stage of the disease, shall be quarantined for 16 days from time of last exposure, and be vaccinated.

8. Quarantine of small-pox patients shall be maintained until they have completely desquamated or scaled off, as certified by a reputable physician, and until the house and its contents have been properly disinfected under the supervision of the board of health. Persons in the house with the patient who are not protected against small-pox by a recent successful vaccination or a former attack of the disease, shall be quarantined for 16 days from the time disinfection of the house is completed.

9. Persons who have recently recovered from small-pox, or suspected small-pox, the nature of their malady not having been known or recognized at the time of their illness, shall be returned to their homes until their dwellings and contents, including the clothing of all the inmates, are properly disinfected under the supervision of the board of health.

10. No child in a community in which small-pox actually exists, shall be permitted to attend any public, parochial or private school without presenting satisfactory evidence of having been successfully vaccinated.

11. It shall be the duty of the local board of health or its health officer receiving a report of a case of small-pox within the jurisdiction of such board to at once report the case, by telegram when possible, to the State Board of Health.

12. The Secretary of the State Board of Health, as its Executive Officer, is hereby authorized and directed to secure the strict enforcement of the above rules and regulations, with such modifications thereof and such additions thereto as the exigencies of any particular case may demand.

Attest: C. O. PROBST, M. D.,

Secretary.

Adopted Nov. 29, 1898.

On motion of Dr. Hoover the Secretary was instructed to write to the managers and superintendents of all public institutions and colleges in Ohio, calling attention to the prevalence of smallpox, and urging vaccination of those under their care.

A communication from Mr. John J. McMaken, President of the Board of Control, of Hamilton, was presented, requesting the Board to approve the issuing of bonds by the city of Hamilton for not more than \$5,000, to be used for sanitary purposes.

The Secretary was instructed to refer the matter to the Attorney-General for advice.

The Board voted to approve the plans for sewer districts Nos. 31 and 32 of Toledo, previously reported upon and approved by mail vote.

No further business presenting the Board adjourned.

C. O. PROBST,

Attest:

Secretary.

JANUARY MEETING.

A regular meeting of the State Board of Health was held in the office of the Secretary, at Columbus, January 18th, 1899.

Present: Drs. Kahle, Hartzell, Stanton, Crossland, Gemmill and Warner.

The minutes of the last meeting were read and approved.

The Secretary presented his report, which was ordered filed for publication.

Rules governing the use of the Board's Laboratory were presented by the Secretary.

Dr. Crossland moved that the rules be amended so as to provide that examinations should be made on request of the Board of Health or health officer.

The motion was carried.

It was then voted, on motion of Dr. Crossland, to adopt the rules as amended.

The Secretary presented a circular letter to managers of Public Institutions relative to the prevention of tuberculosis, and offering, on the part of the Board, to make examinations of sputum of suspected cases of that disease.

On motion the letter was adopted and the Secretary was instructed to bring the matter to the attention of the superintendents of public institutions at such time as he might deem favorable.

Dr. Warner spoke of the desirability of providing, in some manner, for the proper disinfection of railway and street cars.

On motion of Dr. Crossland it was voted to refer the matter to a committee of three.

The Chair appointed on this committee, Drs. Warner, Stanton and Mr. Hartzell.

A communication from property holders near the Fairmount Children's Home, complaining of a nuisance arising from the sewage of that institution, was presented.

On motion of Dr. Gemmill, the matter was referred to Mr. Hartzell for investigation and report.

The Board voted to approve the issuing of bonds for not more than \$5,000 by the city of Hamilton for sanitary purposes, previously reported upon and approved by mail vote.

A communication reporting a nuisance arising from improper drainage of a school house in Union township, Van Wert county, was read. The Secretary was instructed to refer the complaint to the township board of health and give instructions for the abatement of the nuisance.

Adjourned to 10 a. m. of the following day.

SECOND SESSION.

January 19th, 1899.

The Board reassembled at 10:30 a. m. Present as before.

On motion of Dr. Stanton the resident member and the Secretary of the Board were appointed a committee to represent the Board in the matter of securing suitable rooms for the Board in the addition to be made to the State House.

The Secretary, on motion of Mr. Hartzell, was instructed to revise the rules of the Board governing the transportation of dead bodies, and to send copies thereof to the members of the Board.

On motion of Mr. Hartzell it was voted to continue the investigation of rivers, and to take up during 1899 the Muskingum and Cuyahoga rivers.

The question of employing an engineer was discussed, and on motion of Dr. Stanton the matter was referred to the Secretary for investigation and report, to be made as soon as possible.

The following resolution offered by Mr. Hartzell and the Secretary was adopted:

WHEREAS, The saving of human life and the prevention of disease are among the highest and most sacred duties of state; and

WHEREAS, The United States of America is the only large nation that has failed to establish a Department of Health to protect the people in this their most vital interest;

Be it resolved, By the Ohio State Board of Health in regular session assembled, that Ohio's representatives in Congress be most respectfully urged to use their influence for the creation of a National Bureau of Health; and

Be it further resolved, That in the opinion of this Board such Bureau should be given full control of *all* public health functions now exercised by authority of the United States, and that we approve of the general idea, expressed in the Spooner Bill now before Congress, of having an advisory council consisting of one member from each State, as a means of securing united and harmonious action in the administration of public health matters; and

Be it further resolved, That this Board unanimously favors the passage of House Bill No. 5175, providing for a Commission of bacteriological experts to ascertain the cause of yellow fever.

No further business presenting the Board adjourned to take part in the proceedings of the joint meeting of State and local Boards of Health.

Attest:

C. O. PROBST,
Secretary.

QUARTERLY REPORT OF THE SECRETARY.

To the President and Members of the Ohio State Board of Health:

Your Secretary respectfully presents the following report as covering the work of the office since the last meeting of the Board, November 29th, 1898.

In the first place I would officially note the appointment of Dr. Frank Warner of Columbus, as a member of the Board to succeed Dr. Hoover of Columbus, whose term of office expired December 13, 1898.

I must beg your indulgence in not presenting as full a report as may be desired, but with the many official visits I have been called upon to make since the outbreak of smallpox it has not been possible to find time to write a report of each visit in detail.

On December 2nd, by request of the health authorities, I visited Gambier. The occasion of the visit was an outbreak of scarlet fever among the students at Kenyon Military Academy. I assisted in the diagnosis of some doubtful cases, arranged for a hospital for suspects, and instructed the local health authorities to maintain a quarantine of all inmates of the Academy for 12 days from the time of the development of the last case. The disease was promptly suppressed.

December 7th, I went to West Alexandria, Preble county, on account of a suspicious eruptive disease reported as prevailing there, and also because of the inability or neglect of the local board of health to enforce quarantine in diphtheria and scarlet fever. I was able to see but one case of the eruptive disease in an active stage. A number of cases had occurred which, according to the statements of three of the local physicians, were of the same character as the one I saw. The disease was not smallpox, but I was unable to determine its exact character. The history of the cases seemed to indicate it to be a contagious skin disease, probably of parasitic origin.

A meeting of the board of health and physicians of West Alexandria was held, and a better understanding of the duties of each in controlling contagious diseases was reached.

On the following day, at the request of the health officer of Lancaster, I visited that place and examined three cases that had been quarantined for smallpox. The attending physician and the health officer assisted in the examination. It was decided that the disease was chickenpox. While in Lancaster another case of smallpox was reported. I examined this case with the health officer. The patient was an adult, vaccinated some years ago, who had had chickenpox. He presented a history of rather severe constitutional symptoms preceding a general eruption which had made its appearance two days before we saw him. I could only pronounce the case "suspicious" though the health officer felt sure it was varioloid. It was decided to publicly announce it as

varioloïd and to enforce proper quarantine and vaccination measures. This was done.

The next day, December 9th, I went to Trenton, Butler county, by request of the Mayor. I found that there had recently been there six cases of diphtheria and membranous croup, five of them fatal. Council had passed an ordinance to establish a board of health, and I was called there to assist in organizing the board, and to advise as to steps to prevent the further spread of diphtheria.

December 13th I visited Pomeroy to examine plans for water works. I have already reported upon this matter, and the plans were approved by the Board by a mail vote.

December 19th I visited Yellow Springs to investigate cases of suspected smallpox in that vicinity, and to advise with the board of health of that place concerning the quarantine of a case of smallpox in the person of a student at Antioch College.

The report of smallpox near Yellow Springs proved to be false.

I advised the board of health to maintain a rigid quarantine of Antioch College until the patient could be safely dismissed.

December 21st, I went to Toledo to consult with Dr. Tobey, Superintendent of the Hospital for Insane, in regard to the vaccination of the inmates of that institution. As this institution draws patients from the district most affected with smallpox, it was considered especially desirable to enforce vaccination there. An arrangement was made to that end.

On December 23rd, I was called to Newark on account of smallpox. I visited the patient who is an engineer on the Sandusky Division of the B. & O. Railroad. He contracted the disease at a hotel in Sandusky. I met the board of health and proper arrangements were made for looking after the case.

On the following day I went to New Lexington, at the request of the infirmary directors and trustees of Jackson township. The question to be determined was the disposition to be made of two cases of supposed leprosy. The township trustees had declared them to be paupers, and there was a difference of opinion as to whether they should be brought to the infirmary. Four of the local physicians were called into the consultation. I did not examine the cases as I had seen them a few years before. They undoubtedly present all the appearances of genuine leprosy, but there is no history of contagion or heredity. I advised against taking them to the infirmary, or even to a separate building on the infirmary grounds, as was spoken of. I was of the opinion that a building should be constructed near their mother's house, which is on an isolated farm, and that the county should bear all the expenses of maintaining them and that the mother, with proper instructions, should be required to care for them. Some legal questions being involved, as the mother and children receive small pensions, it was agreed to refer the question to the prosecuting attorney of Perry county.

January 2nd, with the President of the Board, I visited Hume to investigate suspected smallpox. The cases proved to be chickenpox.

On the following day we visited St. Johns and Geyers, in Auglaize county, on account of smallpox.

January 6th I went to Cleveland to learn the real condition of affairs there as regards smallpox, the Cleveland papers, or some of them, having violently attacked the health officer for alleged mismanagement of the disease. I visited the smallpox hospital, called the "Detention Hospital," with Dr. Hess, the health officer. This hospital, just erected, is located in a ten-acre field owned by the city. It is distant by the present road (a new one is to be built) about eight miles from the public square, and about three miles from the nearest street car line. The building is of brick, well constructed, with a capacity of twenty-four patients. As many as thirty-three have been cared for there recently. There are in the hospital at present a house physician, matron, nurse and employes. The total number admitted up to the time of my visit was sixty-six. All but one or two cases reported in the city had been mild, and only two patients, recently taken ill, were in bed. A few hundred yards from the hospital is a farm building which is being used for what may be more appropriately called a *detention* hospital. Persons who have been exposed to smallpox are removed to this building. For instance, when a case of smallpox is found in a family the patient is taken to the hospital and the other members of the family to this house, where they are held twenty-one days, the health officer claiming to have found cases with an incubation period of that duration. There were but six or seven persons in this house when I was there. Vaccination of school children is being strictly enforced in Cleveland, according to the health officer. Nothing is known as to how the disease was introduced, and in most of the cases following the first outbreak it has been impossible to trace their origin. This usually means danger, as pointing to concealed or unrecognized cases of smallpox.

January 11th, I was called to Middlefield, Geauga county. A young woman there was reported to have smallpox, and many persons had been exposed. The case was reported by a young doctor of the village, and the people were unwilling to accept the diagnosis. The board of health had endeavored to have physicians from neighboring towns investigate the case, but they refused to have anything to do with smallpox cases. I saw the patient on the eleventh day of her illness. By this time the eruption, with which she had suffered, had almost entirely disappeared. She had broken out the day before with measles, which was profuse when I saw her. I could not be positive as to whether she had had smallpox, but from the physician's history of the case, and from what was said by the patient and her mother, it was at least suspicious. I instructed the board of health to treat the case as smallpox, without expressing to them my doubts as to its character.

The total number of cases of smallpox reported since its first appearance in Ohio in April 1898 up to January 18th, 1899, is six hundred and sixty-eight (668), with five (5) deaths.

At the present time the disease still exists in Cincinnati, Cleveland, Blanchester, Selma, New Carlisle, Donnelsville, Newark, Middlefield, St. Johns, New Hampshire, Geyers and Cridersville.

The danger of spread of the disease is greatest at Cincinnati and Cleveland.

Respectfully submitted,

C. O. PROBST,

Secretary.

APRIL MEETING.

A regular meeting of the State Board of Health was held at the Grand Hotel, Cincinnati, Ohio, April 20th, 1899.

All members were present. Dr. Kahle presiding.

Mr. Riggs, of Toledo, as consulting engineer, presented

a. Plans for a sewerage system for the city of Wellsville.

b. Plans for an extension of the sewerage system of the city of Lorain.

c. Plans for a storm water sewer for South Lorain, to be constructed by The Johnson Company, for territory within the corporation of said city and owned by said Company.

Mr. Bradbury, representing the engineering firm of Snow and Barbour of Boston, presented plans for the disposal of the sewage of the Hospital for Epileptics at Gallipolis.

Mr. Lillie, City Engineer of Youngstown, presented plans for storm water relief sewers for that city, and also presented plans of what is known as the Market street sewer of that city, a sewer which had already been constructed and which had not been approved by the State Board of Health.

The minutes of the January meeting of the Board were then read and approved.

The Secretary presented his Quarterly Report which, on motion of Dr. Stanton, was received and ordered filed.

An invitation was read from Mr. August Hermann, President of the Board of Trustees Commissioners of Water Works of Cincinnati, to visit the experimental filter plant in that city.

On motion of Dr. Gemmill the invitation was accepted for 9 a. m. of the following day.

The Secretary presented plans for a new water supply and a sewage disposal plant for the Boys' Industrial School at Lancaster, plans having been prepared by Mr. J. P. Force, consulting engineer.

On motion of Dr. Stanton said plans were approved.

The plans for sewage disposal works for the Hospital for Epileptics at Gallipolis were considered.

On motion of Dr. Miller said plans were approved.

The storm water relief sewers proposed for Youngstown were taken up.

On motion of Dr. Stanton the plans were approved.

On motion of Dr. Miller it was voted to disapprove the outlet of the Market street sewer of Youngstown.

The plans for a sewerage system for the city of Wellsville were taken up.

On motion of Dr. Miller the plans were approved with the provision that the city of Wellsville should be required to purify its sewage in a manner satisfactory to the State Board of Health when demanded by said Board.

On motion of Dr. Stanton the Secretary was instructed to consult the Attorney-General in reference to having the Sheffield Land Company comply with its agreement to purify the sewage of the lands of said Company, and it was voted to take no action on the proposed storm water sewer of the Johnson Company until after the Attorney-General had rendered his opinion.

On motion of Dr. Gemmill it was voted to approve plans for additional sewerage for the city of Lorain.

On the recommendation of the Secretary it was voted not to make an investigation of the Cuyahoga river this year, as had been decided upon at the previous meeting.

The Board adjourned until 1 p. m. of the following day.

SECOND SESSION.

April 21st, 1899.

The Board reassembled at 2 p. m.

All members present except Dr. Miller.

A communication was presented from Mr. Hillis, Secretary Board of Trustees of the Boys' Industrial School at Lancaster, requesting the State Board of Health to make an investigation of the condition of the hospital at that institution.

Dr. Stanton moved that a committee of two be appointed to make the investigation.

The motion was carried, the President appointing on the committee Drs. Warner and Probst.

A communication was presented from the Engineer of Piqua, giving a description of a storm water sewer proposed for that city, and asking the Board's approval of the same.

On motion of Dr Stanton it was voted to approve the outlet of said storm water sewer with the provision that no house drainage be permitted to enter said sewer.

A communication was presented from Mr. McKenzie of Lakeside requesting that he be allowed to use his well for stock purposes.

On motion of Mr. Hartzell the matter was referred to the Secretary with instructions to communicate with the board of health of Lakeside and learn whether it would be advisable to comply with the request.

A communication was presented from Dr. Erwin W. Schueller, Superintendent of Health of the city of Columbus, in reference to the failure of certain physicians of the said city to report to the Health Department cases of smallpox occurring in their practice.

On motion of Dr. Stanton the Secretary was instructed to send a copy of this communication to the Director of Public Safety of Columbus, with the request that said physicians be prosecuted for violation of the law.

On motion of Mr. Hartzell it was voted to send Dr. Gennill and the Secretary as delegates to the meeting of the Conference of State and Provincial Boards of Health of North America, to be held in Richmond, Va., May 23-24th.

On motion of Dr. Crossland it was voted that when the Board should have adjourned it would be to meet in Columbus on June 6th.

On motion of Dr. Stanton the Secretary was instructed to draft a resolution for publication, urging general vaccination, and calling attention to the great probability of smallpox continuing to prevail in this state for some time.

Dr. Crossland moved that the President and Secretary be appointed a committee to consider the matter of a sanitary exhibit at the Centennial Exposition to be held at Toledo, in accordance with the recommendations presented in the Quarterly Report of the Secretary.

The motion was adopted.

Dr. Stanton reported that a nuisance he had been appointed to investigate at Carthage, arising from improper sewerage, had recently been abated.

The Board voted to approve plans for water supply for New Richmond and for Pomeroy, previously reported upon and approved by mail vote.

The Board voted to approve plans for sewage disposal for the Trumbull County Infirmary, with the exception of the proposed emergency overflow for crude sewage which was disapproved, the same having been reported upon and approved by mail vote.

There being no further business the Board adjourned.

Attest:

C. O. PROBST,
Secretary.

QUARTERLY REPORT OF THE SECRETARY.

To the President and Members of the Ohio State Board of Health:

Your Secretary begs leave to present the following report:

Smallpox has continued to occupy much of my time, although by the use of the telephone and by correspondence I have been able in many

outbreaks to give instructions to local authorities and thus avoid the loss of time occasioned by a personal visit. I was obliged, however, to visit the following places on account of the disease: Cincinnati, South Charleston, Columbus pest house, Springfield, Xenia, Clay township, Muskingum county; Springfield township, Clark county; Parkerstown, Coshocton, Howard, Girls' Industrial Home at Delaware, Fredericksburg, Camden, Millersburg, Killbuck and Lancaster.

Information has been obtained concerning each new outbreak, special attention being given to the origin of the first case. The number of cases reported to the Board from January 1st, 1899, to April 17th is 847. The total number of cases reported since the first outbreak in April, 1898, to April 17th, 1899, is 1,515, of which 22 have died. It will be seen that the disease still maintains its phenomenally mild character; and this is also true of smallpox prevailing in other states.

The disease is still present in the following places: Bainbridge township, Geauga county; Camden, Chagrin Falls, Cincinnati, Cleveland, Cleves, Columbus, Coshocton, Fredericksburg, Gallipolis, Girls' Industrial Home (Delaware), Granville, Harrison township, Perry county; Howard, Killbuck, Lafayette township, Coshocton county; Painesville, Parma township, Cuyahoga county; Pleasantville, Plain City, Ripley, Roseville, Sandusky, Sand Hill, Springfield township, Clark City; Tippecanoe, West Farmington, Xenia, Zanesville and Lancaster.

Except in places where the disease has appeared vaccination, from what I have been able to learn, is still greatly neglected, and there remains such a large number of unvaccinated persons in Ohio that, considering the number of centers of infection in this and other states, we can hardly expect to be free from the disease for some time to come. I do not see that the Board can do more than it is now doing for the suppression of the disease.

Plans were approved by the Board by mail vote for purifying the sewage of the Trumbull County Infirmary, with the exception of the proposed emergency overflow for crude sewage which was disapproved.

Youngstown asked for the assistance of the Board in obtaining an improved water supply, and at the request of the water works trustees I visited that city on January 30th and held a consultation with the trustees and their engineer, Mr. Snow of Boston. The trustees are fully awake to the serious pollution of their present supply, which was fully set forth in the Board's report on the condition of the Mahoning river.

The recent prevalence of typhoid fever in Youngstown has accentuated the necessity for early action in the matter. For the six months, ending with March, 1899, there were reported in that city 151 cases and 22 deaths. While some of these cases are traceable to the use of polluted well water, it is from the public water supply that the greatest danger comes.

A new supply is under consideration to be obtained from Mill creek. No sewage directly enters this creek, but samples of the creek water examined by our bacteriologist showed the presence of fecal bacteria. Mr. Snow will report upon the use of this creek for a new supply, and also upon the purification of the present supply. The engineer is especially desirous of having daily measurements of the Mahoning river made by our Board. This we could probably do, in connection with the United States Geological Survey, and without much expense. I wish to recommend that this be done. I desire to know, moreover, whether it is not to be the fixed policy of the Board to lend all possible aid to communities seeking to improve their water supplies, including laboratory examinations when necessary.

On March 24th, I visited Wellsville and looked over plans proposed for sewerage that place, in company with the engineer, Mr. Riggs, who will present the plans at this meeting.

In addition to visits made by the Secretary, the following are to be noted, by members of the Board:

An investigation of scarlet fever at Dunkirk, by Dr. Gemmill, in February.

An investigation of suspected smallpox at Longview Asylum by Dr. Stanton on February 12th.

An investigation of a nuisance at Burgoon by Dr. Kahle, on February 24th.

An investigation of a nuisance at Carthage by Dr. Stanton on February 28th and March 2nd.

An investigation of smallpox at Cleves by Dr. Stanton on March 10th.

An inspection of the sanitary condition of Ashland by Mr. Hartzell on March 28th.

It will be necessary for the Board to take action for the formal approval of plans for the water supply for New Richmond and Pomeroy, and for the sewage disposal works at the Trumbull County Infirmary. These plans were presented to the Board by mail and have been approved by mail vote.

I wish to call attention to the Centennial Exhibition to be held in Toledo, and to suggest that it may be desirable for the Board to take some action looking to a proper sanitary exhibit. I have had a conference with one of the chief engineers, Mr. Riggs of Toledo, and he informs me that the question of providing for exhibition sewage disposal works has already received some consideration. It is highly desirable, in my opinion, there should be also a garbage disposal plant, and water purification. There are many other features of sanitation and hygiene which might be instructively exhibited at that time, and in which our Board would be much interested. By models and drawings, by pamphlets and possibly lectures, a great deal of useful sanitary information might be disseminated.

SEWAGE PURIFICATION WORKS.

I wish to call the attention of the Board to the desirability of making an investigation of the sewage disposal works in Ohio.

We now have municipal disposal works in operation at Canton, Alliance, Oberlin, Clyde, and at the following public institutions: The Mansfield Reformatory, the Hospital for Epileptics (in part), the Children's Home at Alliance, and the Infirmary at Kenton, eleven in all. Works are under way at Fostoria, Shelby, Glenville, East Cleveland, and the County Infirmary near Warren. The Legislature has authorized the construction of works at the Boys' Industrial School at Lancaster.

As regards numbers Ohio is in advance of all but a few eastern states in this matter; and our Board is receiving many complimentary notices in reference to its work in preventing stream pollution and looking after public water supplies.

The sewage disposal plants have not all been unqualifiedly successful. There is reason to fear that some of them will prove to be failures unless proper remedies are applied. The reports of visitors to certain of them have been somewhat unfavorable. I have misgivings that the marked impetus towards sewage disposal in this state will receive a serious check unless something is done to prevent it.

The recommendation that I wish to make is that the Board should have made a thorough investigation of all sewage disposal works in the state. The character of the soil, as determined by measurements of its particles, the area of filter beds in actual use, the amounts and characters of the sewage applied and the character of the effluent, the general condition of the plant as regards appearances and freedom from nuisance, the actual cost of construction and maintenance, these and other points should be fully discussed in a carefully prepared report. Where the results have been unsatisfactory, the reasons therefor should be fully set forth.

Many of our towns are in urgent need of sewage purification works. They will naturally study first what has been done in Ohio, and a report of this kind would be of the utmost value to them. Not only that, but a study of these plants such as I have in mind, would enable the Board to point out, and perhaps remedy, the conditions which in some places have led to more or less unsuccessful results in sewage purification.

I would urge the importance of keeping all these plants under supervision, and of reporting annually upon their condition. This work, to be of value, should be gone into in a most thorough manner. It would be better, I think, not to take up the matter until the Board feels that it can afford to give to it the necessary time and money.

PROPOSED CHANGES IN HEALTH LAWS.

By request I presented a paper on "Boards of Health and Their Relation to City Government" at the meeting of the Ohio League of

Municipalities held in Zanesville January 24th-27th. A member of the Municipal Code Commission who was present, requested me to appear before the Commission and present my views on changes required in laws governing municipal boards of health. This I recently did, and was requested to present to them a written report. I have had no time to prepare this report. The views I expressed at this conference seemed to meet the entire approval of the Commission, being in harmony with their general plan for improved municipal government, and they voluntarily promised to adopt them in their report to the Legislature. I wish to have the advice and assistance of the Board in this matter, but am able at this time to present only an outline of the changes recommended.

1st. A County Medical Officer of Health, selected for fitness, after examination, his salary to be fixed by law.

The Commission suggested that the State Board of Health should conduct the examinations and make the appointments. It might be better if the appointments were made otherwise, but limited to those showing fitness by an examination before the Board. In the beginning it might be best not to ask the county officer to give all of his time to this work, thereby reducing the cost; but he should be subject to call by the State Board. There might be objections to giving him supreme authority in counties containing our largest cities. He should not be removed from office for political reasons. He should keep a complete record of vital statistics at the court house.

2nd. Abolish all boards of health and have the Mayor (the Federal plan of government will be recommended by the Commission) appoint the health officer. This appointment would be made under the civil service rules which will apply to other municipal officers. The Commission expressed no objection to naming a minimum salary for the health officer in the law, fixed according to valuation of property, or to population. I believe the latter to be better.

3rd. Require the trustees of each township to appoint a health officer. It might be advisable to require these appointments to be confirmed by the county health officers. It would also probably be best in this case to provide fixed, minimum salaries.

4th. Enact as laws of the State necessary regulations for controlling contagious diseases, and the common, most dangerous nuisances, so as not to leave these discretionary with health authorities, and so as to have them uniform throughout the state.

This in outline is the plan I presented to the Codifying Commission, and I hope the members of this Board will take time to discuss it so as to give me the benefit of their suggestions.

A part of this plan, barely alluded to, but of great importance, is to provide for the collection and registration of vital statistics.

The Board has been requested to send delegates to the meeting of the Conference of State and Provincial Boards of Health of North America, to be held in Richmond, Va., May 23-25th, 1899.

Respectfully submitted,

C. O. PROBST,
Secretary.

JUNE MEETING.

A regular meeting of the State Board of Health was held at the office of the Secretary, in Columbus, June 6th, 1899.

The Board was called to order at 8 p. m.

All members were present except Dr. Miller of Cleveland.

Dr. Kahle presided.

The minutes of the last meeting were read and approved.

Messrs. Kinney and Boyer appeared before the Board with plans for a water supply for the village of Jackson, and requested that they be approved. In this connection the Secretary presented a report upon the proposed Jackson supply, from information furnished by the engineer and chemist.

Mr. Kauffman, Director of Public Improvements, Mr. Crum, Director of Law, and Mr. Griggs, City Engineer, of Columbus, appeared before the Board and presented some changes in the plans for increasing the water supply of the city of Columbus.

Mr. Kline, an engineer from Dayton, presented plans for the disposal of sewage from the Montgomery County Infirmary, and requested that they be approved.

The Secretary presented his Quarterly Report, which was approved and ordered filed for publication.

The Secretary presented a report upon the application of Gloucester for approval of a public water supply to be obtained from an abandoned coal mine.

It was moved by Mr. Hartzell, and duly seconded, that the proposed source of water supply for Gloucester be disapproved.

The motion was unanimously carried.

The Secretary presented a report, prepared by the engineer, on the condition of the public water supply of Urbana, an investigation having been requested by the Mayor of Urbana.

It was voted to refer the matter to Dr. Stanton as a committee to make an investigation and report.

It was moved by Mr. Hartzell, and duly seconded, that the plans for sewage disposal for the Montgomery County Infirmary be approved.

The motion was unanimously carried.

The Secretary presented a communication from the Board of Health of Youngstown, requesting the Board to reverse its action taken at the

last previous meeting in approving the outlet of a storm water sewer for that city.

On motion of Mr. Hartzell, the Secretary was instructed to say to the board of health of Youngstown that the State Board of Health respectfully refused to reverse its former action in the matter.

The question of approving plans for a storm water sewer for the city of Lorain, or, more definitely, for the Sheffield Land and Improvement Company, as submitted at the April, 1899, meeting, by Mr. H. E. Riggs, engineer, of Toledo, was taken up for discussion.

On motion of Mr. Hartzell it was voted to approve plans for said storm water sewer, conditioned on its receiving nothing but storm water and cellar drainage.

The Secretary presented a communication from the health officer of Caldwell in reference to approving the outlet of a private sewer to be constructed in that place.

It was the opinion of the Board that the outlets of private sewers did not come within the jurisdiction of the State Board of Health, and on motion of Dr. Gemmill the Secretary was instructed to refer the matter to the board of health of Caldwell.

Plans were presented by the Secretary for a storm water sewer proposed for the village of Niles, with a request from the village clerk that the outlet of said sewer be approved.

On motion of Mr. Hartzell it was voted to approve the outlet of said sewer provided a copy of an agreement of the property holders contributory to said sewer, to the effect that the sewer should not be used for house drainage purposes without the consent of the State Board of Health, be filed with the State Board of Health.

A communication from the Torrent Pump Company of Cleveland, requesting the Board to authorize them to make a demonstration at Lakeside of their claims of purifying well water was read.

On motion of Dr. Stanton the proposal was rejected.

On motion of Dr. Stanton it was voted to proceed with the election of officers.

Dr. Gemmill nominated for President Mr. Josiah Hartzell of Canton, and moved that the rules be suspended and that the Secretary be instructed to cast the ballot of the Board for Mr. Hartzell as President. The motion was carried.

The Secretary reported that he had cast the ballot as ordered and Mr. Hartzell was declared President, to take his seat at the next regular October meeting of the Board.

Dr. Stanton nominated Dr. W. T. Gemmill of Forest for Vice-President of the Board, and moved that the rules be suspended and that the Secretary be authorized to cast the vote of the Board for Dr. Gemmill as Vice-President.

The motion was carried and the Secretary reported that he had cast the ballot as ordered, and Dr. Gemmill was declared elected as Vice-President, to take his seat at the next regular October meeting of the Board.

On motion it was voted to adjourn until 5 p. m. of the following day.

SECOND SESSION.

June 7th, 1899.

No quorum being present at 5 p. m. an adjournment was taken until 12 o'clock noon of the following day.

THIRD SESSION.

June 8th, 1899.

The Board reassembled at 12:15 p. m.

Present: Drs. Kahle, Crossland, Warner and Stanton.

The plans for changes in the Columbus water supply were taken up for consideration.

On motion of Dr. Stanton it was voted that the plans for the construction of a storage dam in the Scioto river for the purpose of furnishing an additional water supply for the city of Columbus, as proposed by the Director of Public Improvements of said city, under date of June 6th, 1899, be approved, provided

a. That the ground to be flooded by water by the proposed dam shall be stripped of vegetation and upper layers of soil (earth).

b. That the water so stored shall not be used for a public water supply unless purified in a manner satisfactory to the State Board of Health.

c. That completed plans for purifying the stored water be submitted to the State Board of Health within a reasonable time.

A yea and nay vote being called for resulted in four votes in the affirmative and none in the negative.

Dr. Crossland reported upon plans for additional sewerage for the city of Zanesville, and moved that the outlet for said sewer be approved. The motion was carried.

The question of approving the water supply for the village of Jackson was taken up for consideration.

On motion of Dr. Stanton it was voted to defer action in the matter until the results of further borings for ground water could be made known.

There being no further business the Board adjourned.

Attest:

C. O. PROBST,

Secretary.

QUARTERLY REPORT OF THE SECRETARY.

To the President and Members of the Ohio State Board of Health:

GENTLEMEN:—Your Secretary begs leave to present the following report of work done since the last meeting of the Board:

Following the meeting, Mr. Horton and I made a tour of the Muskingum watershed in order to locate stations for the collection of samples of water. The April samples were taken at the time. Stations have been located at the following places: Cambridge, Canal Dover, Canton, Coshocton, McConnelsville, Mansfield, Marietta, Massillon, Mt. Vernon, Newark, Shelby, Uhrichsville, Wooster and Zanesville.

At McConnelsville I met the consulting engineer, and the question of approving a water supply for that village was discussed. The village is endeavoring to find a ground water supply, but if this should not be available would be obliged to go to the Muskingum river. The authorities are much pleased that the Board has taken up the investigation of the quality of the Muskingum river water.

May 10th and 11th I attended the meeting of the Ohio State Medical Society at Springfield, though not as an official delegate of this Board. I speak of the fact because of the action taken by the Society, following my presentation of a paper on dairy sanitation. Resolutions were adopted calling upon Legislature to empower the State Board of Health to make examinations of tuberculous cows, and to make an appropriation to the Veterinary Department of the Ohio State University to enable the Board to carry on such work. Also asking Legislature to give the State Board of Health authority to adopt and enforce regulations controlling the construction of dairy stables. A committee was appointed to bring this matter to the attention of the next General Assembly.

The following letter was received from Mr. Christian, Chairman of the Committee on Sanitation of the State Centennial Commission:

TOLEDO, OHIO, April 28, 1899.

C. O. Probst, M. D., Secretary of State Board of Health, Columbus, Ohio:

DEAR SIR: The Committee of the State Centennial Commission, having under consideration the matter of a sanitary exhibit to be conducted under State auspices as outlined by Mr. F. Herbert Snow along the lines approved by yourself and Board, have requested this gentleman to prepare, under the direction of yourself and Board, a detailed statement of the proposed exhibit, its requirements and cost of construction and operation, and to report to the undersigned at as early a date as convenient.

The Committee would like to have this report appended to a report by the State Board of Health containing recommendations and such suggestions as in its judgment the case may require.

I am yours truly,

GEORGE B. CHRISTIAN,
Chairman Committee on Sanitation.

Dr. Kahle, Mr. Snow and I went to Toledo on May 15th and met the engineers employed by the Centennial Company to prepare the grounds, and several members of the Centennial Commission. Mr. Snow will present a report and estimate of cost of putting in sewage disposal works to carry off all the sewage and at the same time to be used as an exhibition plant.

The question of the scope of the sanitary exhibit was discussed, but no definite report upon it has as yet been prepared.

Smallpox has been reported in the following places since the last meeting of the Board:

Columbus, Cincinnati, Cleveland, Newburgh township, Cuyahoga county; West Jefferson, Radnor township, Delaware county; Sandusky, Castalia, Thorn township, Perry county; Mill Creek township, Union county; Clinton township, Franklin county; Toledo, Pike township, Madison county; near Fredericksburg, Union township, Brown county; Ironton, Bethlehem, Euclid, Kelley's Island, Avon, Millersburg, Coshoc-ton, Newton, Carthage, Collinwood, Springfield, Washington township, Clermont county; Ridgeville, Madisonville, Green township, Gallia county; Fredericksburg, Mayfield, Empire, Massillon, Pleasant Hill, Lockland, Salt Creek and Higginsport.

This makes a total of 1882 cases of smallpox and 30 deaths which have been reported from the first outbreak, April 6th, 1898, to June 6th, 1899.

In addition to the visits made by the Secretary the following by members of the Board are to be noted:

Dr. Kahle visited Troy and Findlay to advise with the local health authorities concerning the abating of certain nuisances reported.

Dr. Stanton investigated cases of smallpox at Higginsport.

Dr. Gemmill visited Dunkirk to investigate the character of some disease prevailing there, suspected to be smallpox.

Dr. Warner and Dr. Crossland visited the Boys' Industrial School at Lancaster, in accordance with the action taken by the Board at the last meeting.

Dr. Crossland visited Zanesville in regard to sewerage.

Berea made application for approval of a new water supply and Dr. Miller was appointed by the President to make the necessary investigation.

Other matters which have come up and which should be presented to the Board are not noted in this report and will be presented later.

Respectfully submitted,

C. O. PROBST,
Secretary.

AUGUST, SPECIAL MEETING.

A special meeting of the State Board of Health was held at the Hollenden Hotel, Cleveland, Ohio, August 16th, 1899.

There were present Drs. Kahle, Stanton, Hartzell, Miller and Warner. Dr. Kahle presided.

A telegram was read from Dr. Gemmill, announcing that it would be impossible for him to be present at the meeting.

The minutes of the last meeting were read and approved.

The Secretary presented his Quarterly Report, which, on motion of Dr. Stanton, was received and ordered filed.

Mr. H. H. Braten, Mr. E. A. Stimpson and Mr. P. J. Fild, representing the village of South Brooklyn, and Mr. G. W. Cantrell, engineer for said village, appeared before the Board with reference to securing the approval of a sewer for said village, to be discharged into the Cuyahoga river; the sewer to be used for carrying off storm water and sewage.

Prof. H. W. Elliott, Mr. N. C. Cotabash and Mr. W. J. Hoffman, a sewer commission for the hamlet of Lakewood, presented plans for a system of sewers for that hamlet, and asked that they be approved by the Board.

Mr. F. Herbert Snow, C. E., addressed the Board on the subject of sewage purification for the city of Mansfield. He asked for some action of the Board in reference to the following communication:

MANSFIELD, OHIO, August 16, 1899.

C. O. Probst, M. D., Secretary of State Board of Health, Columbus, Ohio:

DEAR SIR: The undersigned as consulting engineers for Mansfield would respectfully inquire as to the probable action of the State Board of Health, with respect to approval of plans for the sewerage of districts not now provided with sewers nor draining into existing sewers and requiring a separate and added outfall into Rocky Fork creek.

Would such a discharge be permitted while the creek remains in its present foul condition?

Would it be permitted provided the sewage now polluting the creek be purified?

In other words, is a sewage purification plant for the whole city a necessity before your honorable body will approve plans for new sewer work as aforesaid?

We understand that such approval is necessary to the legal undertaking of said work.

Yours truly,

(Signed) SNOW AND BARBOUR.

Mr. Snow stated that he had been engaged by the water works trustees of the city of Youngstown to prepare plans for a new water supply for that city: That his plans would soon be completed, and that he would be glad if the Board could send a committee to Youngstown to look over the ground and to report upon said plans.

Mr. Snow also presented plans for taking care of the sewage and storm water for the State Hospital for Insane at Newburg, which were approved.

The Board then adjourned to 9 A. M. of the following day.

SECOND SESSION.

August 17, 1899.

The Board reassembled at 9 A. M., the same members being present as before.

It was voted to pay a visit to the sewage disposal works at Glenville, and to the sewage disposal works partially constructed at the village of East Cleveland, and to adjourn until 1.30 P. M.

THIRD SESSION.

August 17, 1899.

The Board reassembled at 1.30 P. M. There were present Drs. Stanton, Warner, Miller and Mr. Hartzell.

Mr. Hartzell presided.

Mr. Hartzell stated that in his judgment the Board should at that meeting outline its policy in reference to the discharging of crude sewage into Lake Erie and the Cuyahoga river, so that there need be no expenditure of money for plans for the construction of sewers which would be contrary to the policy of the Board in regard to this matter. In furtherance of this idea he introduced the following resolution:

Resolved, That this Board is not willing to approve any plan of sewage disposal which contemplates the discharge of crude sewage into Lake Erie or the Cuyahoga river at any point within ten miles of the intake of Cleveland's water supply.

The resolution was adopted.

The question was discussed of the action to be taken in reference to approving plans prepared by the Ideal Manufacturing Company for the American Straw Board Company, and looking to the purification of the waste product of the straw board works located near Tiffin, O.

The matter was disposed of in the following resolution offered by Mr. Hartzell, which was adopted by the Board.

Resolved, That this Board will not be prepared to take action in regard to the application of the American Straw Board Company to approve plans for purifying the waste from straw board works until advised of the results of experiments in such purification now being conducted at Eaton, Indiana.

On motion of Dr. Stanton the Secretary was instructed to go to Eaton, if he should deem it necessary, and to report to the Board the results of such experiments.

On motion of Dr. Miller, Mr. Hartzell, President elect, and the Secretary were appointed to represent the Board at the meeting of the American Public Health Association, to be held in Minneapolis, October 30th to November 4th, 1899.

The Secretary presented communications from Dr. W. E. Williams, Chairman of the Water Works Committee of the Council of Jackson,

with reference to the public water supply approved by the Board for said village. He protested against using the supply on two grounds:

First, since its approval by the Board, a supply of water has been found within a reasonable distance of Jackson which would be of much greater purity and adequate in quantity. Second, the conditions laid down by the Board in regard to removing sources of pollution from the old mine were practically impossible for the Company to fulfill.

As the Board had approved this source of water supply upon representation of the water works company that it was impossible to find a suitable supply of ground water within a reasonable distance of Jackson, it was voted to reconsider the vote of approving the water supply of Jackson to be obtained from what is known as the Huron coal mine, and that the Secretary be instructed to investigate the claim that a much better water supply was obtainable elsewhere.

Plans for disposing of the sewage of the Fairmount Children's Home near Alliance were presented by Mr. Hartzell, and, on motion of Dr. Warner, were approved.

Mr. Hartzell presented a report upon the new water supply proposed for Shreve, and recommended that it be approved.

On motion of Dr. Miller the report and proposed source of water supply were approved.

The Secretary reported that he had been informed that the Sheffield Land and Improvement Company was extending its system of sanitary sewers, such extension not having been approved by the Board. A letter having been addressed to the Sheffield Land and Improvement Company in reference to this matter elicited the following response:

LORAIN, OHIO, *August 10, 1899.*

C. O. Probst, M. D., Secretary of State Board of Health, Columbus, Ohio:

DEAR SIR: Yours of the 9th inst. in regard to sewer system plan for our town, is at hand. Our new sewer system, as approved by the Board of Health, is for storm water purposes ONLY, having no provision whatever for the reception of house drainage. In letting contract for this work, we have also included some sewer pipe for the extension of our sanitary system as is to be made by us under approval of the City Board of Health. You will note in this regard that it does not involve a new system or new outlet for sanitary sewerage, but we are extending the present system as originally laid out and approved.

Hoping that this answers fully your inquiry, we are,

Very truly yours,

THE SHEFFIELD LAND AND IMP'T CO.,

(Signed) PIERRE S. DU PONT.

The matter was referred to the Secretary for further investigation and report.

The communication presented by Mr. Snow was taken up, and, on motion of Dr. Stanton, it was voted that the Board would disapprove the discharging of raw additional sewage into Rocky Fork creek by the city of Mansfield.

Dr. Miller and the Secretary were appointed a committee to visit Youngstown and report upon plans proposed for providing a new water supply for that city.

Dr. Stanton reported upon investigations he had made of alleged nuisances at Lebanon, Ohio, one arising from the drainage of a creamery at that place, and the other from the sewage of the Children's Home. The Secretary was instructed to send a notice to the local board of health of the Board's approval of Dr. Stanton's report, and to request that board to avoid any unnecessary delay in having said nuisances abated.

On motion of Dr. Warner the Secretary was authorized to purchase a camera, and to arrange for illustrating the next report upon the examination of rivers.

The Secretary reported that he had had a conference with the Secretary of the State Board of Agriculture in reference to presenting at the various Farmers' Institutes held in Ohio the subject of the prevention of tuberculosis. Two hundred and fifty such meetings are held in Ohio each year, each meeting lasting two days. The Secretary of the State Board of Agriculture promised his assistance and cooperation. The matter of arranging for lectures upon this subject at these various meetings was referred to Dr. Warner and the Secretary as a committee, with power to act.

Dr. Warner reported that he had visited the hospital for the Boys' Industrial School at Lancaster some time before upon the request of the authorities of that Institution; that he found the hospital not in keeping with the other buildings, and that it would be desirable for the next Legislature to authorize the construction of a suitable building for hospital purposes for that institution.

On motion of Dr. Miller the report was approved.

The following reports, which had been previously submitted to the Board by mail, and adopted, were submitted to a *vive voce* vote of the Board, to wit:

The report of Dr. Kahle upon additional water supply for Cridersville.

On motion of Dr. Warner the plans for an additional water supply for Cridersville were approved.

The report by Dr. Miller upon a water supply for Berea.

On motion of Dr. Warner the plans for a water supply for Berea were approved.

The report by Dr. Kahle upon additional sewerage for Findlay.

On motion of Dr. Stanton the plans for additional sewerage for Findlay were disapproved.

The report by Dr. Stanton of an investigation of the condition of the water supply of Urbana.

On motion of Dr. Miller the report was approved.

The report by Dr. Gemmill upon the condition of a fertilizing factory near Kenton.

On motion of Dr. Warner the report was approved.

The report of Dr. Gemmill upon the condition of the post office building in Kenton

On motion of Dr. Warner the report was approved.

The Secretary presented reports upon

The sanitary condition of Ripley,

Sewers for Lakewood,

The pollution of the Sandusky river at Tiffin by straw board works,

The water supply of Norwalk,

The investigation of an alleged nuisance arising from odors from a garbage crematory in Toledo, and

The sanitary condition of Lakeside.

On motion of Dr. Stanton these reports were approved.

There being no further business the board adjourned.

Attest:

C. O. PROBST,

Secretary.

REPORT OF THE SECRETARY.

To the President and Members of the Ohio State Board of Health,

GENTLEMEN: Your Secretary begs leave to present his report as follows:

On June 15th, at the request of the board of health, I visited Proctorville on account of an outbreak of smallpox. Proctorville is a small village on the Ohio river, in Lawrence county. There had been a question as to the nature of one or two cases of eruptive disease that had occurred there, which the health officer at the beginning was inclined to believe was chickenpox. The disease evidently started from a young man employed on the steamer "Bostona" and who came home to Proctorville and presented himself to a physician on April 10th, having a pustular eruption at that time. He went back to his boat after some days, and the disease then appeared in the family in which he had been staying. At the time of my visit there had been some eight or nine cases, and there was still doubt expressed as to the nature of the disease. I examined several cases and had no hesitancy in declaring the disease smallpox. The board of health was already enforcing quarantine measures, and full instructions were given to the board in reference to disinfection, discharge of patients, and for the prevention of the spread of smallpox. The outbreak was promptly controlled. There were two additional cases reported a day or two after I was there. On August 9th, however, I received a letter from a resident of Proctorville, stating that they were again having cases of the disease and that the board of health was attempting to suppress facts in the case. I at once telegraphed the health officer, Dr. W. W. Reynolds asking for a full

report as to the situation there and offering to go to Proctorville if the board of health should deem it necessary. He wrote me under the date of August 10th, that they had at that time four cases of smallpox, three in one family, and one in another. As to the origin he said "These cases came from an unsuspected and smuggled case in a family where there are now three cases and which was situated on a lot adjoining the worst case we had." He reports that immediately upon discovery of these cases vigorous measures were taken by the board of health to enforce proper quarantine and prevent further spread of the disease.

On July 13th, at the request of the health officer, Dr. C. Eugene Stroud, I went to Sandusky to meet a special committee of the board of health which had been appointed to consider and report upon additional measures for the suppression of smallpox. Smallpox appeared in Sandusky September 22nd, 1898, and has lingered there to this time; a total of 118 cases having occurred, but without a single death. There was a feeling of unrest among the citizens, and of distrust as to the efficiency of the measures that were being taken by the board of health to suppress the disease. So far as I was able to learn the board of health was doing all that could be done by ordinary measures for the suppression of the disease. There had, however, been no enforcement of vaccination, although many persons had been vaccinated; and no plan had been devised to get reports of light, concealed cases. It was cases of this kind that were keeping the epidemic alive. No deaths having occurred, the majority of the cases being but slightly ill, the people had a greater horror of quarantine than of smallpox. A small building had been erected by the board of health for hospital purposes, and some of the cases had been sent there, though the majority were quarantined in their homes. I met the committee of the board and the situation was fully discussed. The recommendations I made to the committee, which were practically adopted by the board of health at a subsequent meeting, are embraced in the following rules:

BOARD OF HEALTH ENACTMENT.

Be it enacted by the board of health of Sandusky, Ohio, that for the better protection of the public health and to prevent the spreading of contagious and infectious diseases in Sandusky, O., the following rules be enacted:

First—"It is hereby made the duty of the parents, guardians, or those having control of any child or children within Sandusky, O., to immediately report to the health officer all eruptive diseases or conditions occurring on said child or children, giving their names, the street and number of residence, except when a physician is called, when it is made his duty to report to the health officer concerning said child or children in accordance with the rules and regulations of the board

of health;" and it shall be the duty of all adults to report to the health officer all eruptive diseases occurring on themselves, when a physician has not been consulted.

Second—During an epidemic or threatened epidemic of contagious or infectious disease, the board of health may appoint as many physicians or other competent persons, as may become necessary to make a house to house canvass or inspection for concealed and unreported cases of said diseases, and also to vaccinate those not recently successfully vaccinated, and to report to the health officer those vaccinated and those refusing to be vaccinated, and all those refusing to be vaccinated may be quarantined in accordance with the laws of Ohio, and the adopted rules of the board of health of Sandusky, Ohio. Said physicians or others so appointed shall have the power of sanitary policemen, viz.: the right to enter and search each and every house, and in the event of discovering any contagious or infectious disease or any eruptive disease, to immediately report said disease to the health officer, in accordance with the adopted rules of the board of health, giving names, street and number of house. The physicians or others who are appointed hereunder, shall receive such compensation as the board of health may determine.

Third—Any person or persons violating any or either of the foregoing rules, shall on conviction thereof before the mayor of the city of Sandusky, be fined not to exceed the sum of one hundred dollars, or imprisoned for any time not exceeding ninety (90) days, or both, but no person shall be imprisoned under this rule for the first offense, and the prosecution shall always be as, and for a first offense, unless the affidavit upon which the prosecution is instituted, contains the allegation that the offense is a second, or repeated offense.

Fourth—This act shall take effect and be in force from and after its passage and due publication.

Passed August 1, 1899.

Published August 3, 1899.

Attest:

C. B. WINTERS,

Clerk of Board of Health.

The object of this first rule is to be able to punish heads of families, or those who have smallpox in their families and who fail to call a physician or to report the fact to the board of health. While the law requires the owners of buildings and heads of families to report smallpox to the board of health, it is impossible to enforce this law from the fact that one could not prove that such persons knew that the disease was smallpox.

The health officer reported, under date of August 12th, that there had been eight additional cases since my visit.

On July 22nd, by request of the health officer, Dr. C. W. King, I went to Dayton to examine a suspected case of smallpox. Dr. King

had telephoned me a few days before, reporting a suspected case and asking me to come and examine it. I was unable to go at the time but from his description of the case I felt sure it was smallpox, and so assured him. The first patient was taken to the smallpox hospital. The case I was called to see was in another part of the city and in a family that had not had any connection with the first case. I found not one but three cases of smallpox in the family, and further that other members of the family had had the disease some weeks before. The cases we found were all taken to the smallpox hospital, and quarantine measures established. The origin of the outbreak at Dayton is traceable to a man who came there from Cincinnati and was taken sick with smallpox soon after his arrival. This case was not seen by a physician and it was not until weeks after he had the disease that other cases were found, traceable to this source of infection. In all there have been ten cases reported at Dayton.

I have here reports, which I will present later, upon other investigations which I have made as follows:

July 12th, I visited Norwalk to investigate their public water supply, to determine, if possible, the cause of the development of bad odors in the water supply which was giving rise to much complaint among the users.

July 18th, I went to Toledo to investigate an alleged nuisance arising from odors from a garbage crematory erected within the city limits.

On July 19th I went to Lakeside to investigate the sanitary condition of that place.

On July 25th I visited Tiffin and made an investigation of the Sandusky river and straw board works.

July 29th I went to Ripley at the request of the mayor and council to advise with them relative to the introduction of a sewerage system.

August 1st, at the request of the Trustees of the Hamlet of Lakewood, I visited that place to attend a meeting to discuss plans for sewerage the hamlet.

The health officer of Cincinnati, Dr. W. A. R. Tenney, under date of July 17th, reported that he had just discovered four cases of smallpox in one house. There had been no cases of the disease in Cincinnati reported for seventeen days prior to that time, and the health officer was of the opinion that the epidemic was at an end. One of these cases had been diagnosed by the resident district physician as chickenpox, and it was only when Dr. Stanton of this Board was called to see the case that proper diagnosis was made. Since that time the health officer has reported four cases in Cincinnati.

On August 8th, the health officer of Columbus, Dr. W. D. Deuschle, reported that he had just discovered four cases of smallpox in a house

occupied by several colored families, the adult males of which were working in a pipe foundry in Columbus. This city had been free from smallpox for some time, all of the patients having been discharged from the pest house, which had been closed. The health officer reported that some time ago they had had several cases among the workmen of the pipe foundry. He wished to be advised in regard to reopening the smallpox hospital. I counseled that this be done and the patients taken there at once, and also advised that physicians be sent to the families of all persons working at the pipe foundry to look for concealed or unrecognized cases of smallpox, and to vaccinate unprotected members of such families. These suggestions were adopted by the health officer. There are now fourteen cases of smallpox in Columbus.

Under date of July 13th, the health officer of Cleveland, Dr. George F. Leick, reported nine cases of smallpox which had occurred since his last report of June 24th. Under date of August 11th he reports that six additional cases have been reported since July 13th.

Three cases are reported at Addyston, near Cincinnati, but no cases later than July 14th.

One case of smallpox was reported near Castalia, Erie county, July 28th.

The total number of cases that have been reported to me since my last report to the Board on June 6th, is 156.

It will be seen that smallpox is still prevailing to some extent in Ohio, and that there is reason to fear that there will be a considerable prevalence of the disease during the coming winter.

In addition to investigations by the Secretary since our last meeting, Drs. Warner and Crossland visited the Boys' Industrial School at Lancaster with reference to alleged defects in their present hospital.

Dr. Gemmill visited Dunkirk on account of scarlet fever; Fostoria on account of a reported case of smallpox, and Kenton to investigate an alleged nuisance.

Mr. Hartzell visited the Fairmount Children's Home, near Alliance, in reference to the disposal of sewage; and Shreve in regard to the question of a public water supply.

Dr. Miller visited Berea to investigate the question of a public water supply.

Dr. Stanton visited Urbana in reference to a possible pollution of their water supply; Lebanon and Colerain township, Hamilton county, on account of nuisances.

Dr. Kahle visited Findlay in regard to a nuisance occasioned by stock yards, and in reference to sewers; Cridersville in reference to a water supply, and Osgood on the question of the construction of a sewer.

I have here reports and letters received from the members of the Board in reference to the investigations above enumerated.

The Board should determine whether it will consider at this time, plans prepared by the Ideal Manufacturing Company for purifying the waste from the straw board works at Tiffin, or whether action will be deferred until after the completion of the test at Eaton, Indiana, referred to in my report.

Following is a copy of a communication that was sent to the Commission intrusted with constructing the new state house addition:

COLUMBUS, OHIO, July 22, 1899.

To the Honorable The State Building Commission, Columbus, Ohio:

SIRS: Permit me, in accordance with instructions from the State Board of Health to present to your Honorable Body the needs of this department for additional office rooms, and its prayer for relief from present cramped and unsanitary quarters.

1. The Board needs one large office with desk room for three clerks and two stenographers. This room should be used for general purposes including Board meetings.

Permit me to say here that delegations and committees, often numbering ten to fifteen, frequently appear before the Board, and require seating room.

This room should have large library cases, as the Board now has a valuable library of over two thousand volumes, which by gifts and purchases is constantly increasing.

2. The Secretary needs a private office as much of his work requires that he shall not be subject to the constant interruptions of a general office.

3. A suitable room should be provided for the Engineer.

Under the new law requiring this Board to pass upon all plans for water works and sewerage, the engineering side of our work has grown to be an important one, and our engineer has urgent need for separate quarters.

4. The Board needs at least two suitable rooms for laboratory purposes — One for a chemical laboratory and the other for a bacteriological laboratory. It is impossible for chemical and bacteriological work to be done in the same room.

At the present time the Board is renting two rooms for laboratories in the Board of Trade Building; but this not only entails a considerable outlay, but is extremely inconvenient, as it is necessary for the Secretary to be in frequent communication with the laboratory. I would add that rooms far removed from the ground are preferable for laboratory purposes, so it may be possible to set aside laboratory rooms near the roof and not desirable for offices.

The Board earnestly requests that you take into consideration, in appointing rooms in the new building, that this department is rapidly growing. Beginning with a Secretary, the Board has added two clerks, a stenographer, a chemist and bacteriologist and an engineer, and there will undoubtedly be required a still larger force to meet the growing demands for sanitary investigations.

I should be glad of the privilege of personally appearing before your Honorable Commission in behalf of the Board, and to present further reasons in favor of the requests herein set forth.

I have the honor to be,

Very respectfully,

C. O. PROBST.

Secretary.

A copy of this was also sent to the architects, Messrs. Hannaford and Sons. They replied that while they had nothing to do with the

disposition of the rooms they would be glad to have a conference in regard to the fittings that would be required in rooms to be occupied by the Board. On my way to Ripley, accompanied by Dr. Stanton, I called upon the architects and had a satisfactory interview with them.

The examination of rivers and the measurements of streams has been continued.

Respectfully submitted,

C. O. PROBST,

Secretary.

OCTOBER MEETING.

A regular meeting of the State Board of Health was held at the office of the Secretary on October 18th, 1899.

All members of the Board were present.

The Meeting was called to order at 7.30 P. M. by Dr. Kahle.

The minutes of the last meeting were read and approved.

The Secretary presented his Quarterly Report which was approved and ordered filed for publication.

Dr. Kahle then introduced Mr. Josiah Hartzell as the President elect, who assumed the chair.

Prof. H. W. Elliott, of Lakewood, presented plans for the sewerage of that hamlet.

Mr. F. Herbert Snow, C. E., presented a report upon a proposed exhibition of sewage purification at the Toledo Centennial Exposition.

Mr. E. F. Mull, superintendent of the Water Works of Zanesville, presented a request for the approval of a new water supply for that city. Dr. Crossland, as a committee of the Board, presented a preliminary report upon the character of the proposed supply.

Mr. Hartzell, Committee, presented a report upon a proposition of Canton to increase its water supply by adding to it the yield of a deep well.

The Secretary read correspondence relative to the amount of water supplied by the Dennison Water Supply Company. This Company submitted plans to the Board for approval, which provided for the installation of three Jewell filters. The Board approved the use of these filters but upon the condition that not less than four filters of the size proposed be installed. The report of the Engineer of the Board on the daily pumpage for Dennison and Uhrichsville showed, in the opinion of the Board, that three such filters would be inadequate.

After the presentation of this correspondence and report, it was moved by Dr. Stanton and unanimously voted by the Board that its former action requiring the installation of four filters be sustained.

Adjourned to 9 A. M. of the following day.

SECOND SESSION.

October 19, 1899.

The Board reassembled pursuant to adjournment.

All the members were present.

The President appointed the following persons as members of the Finance Committee: Dr. Frank Warner, Dr. Byron Stanton, and Dr. J. C. Crossland.

The following resolution, presented by Mr. Hartzell, relative to the additional water supply for the city of Canton, was unanimously adopted:

Resolved. That the Ohio State Board of Health sanctions the use of the water derived from the well at the intersection of the Nimishillen creek and Navarre street as an addition to the public water supply of Canton, O.

While the report of our own chemist and bacteriologist, considered by itself, amply warrants such sanction, this Board, actuated by the desire to cooperate with the people of Canton in the securing of the best obtainable results, would encourage a farther exploration for underground water. If an equally pure water could be obtained at a point farther removed from the inhabited district, such water should be preferred as an addition to the City's water supply.

On motion of Dr. Gemmill it was voted to defer action in reference to the proposed new water supply for the city of Zanesville until further examination of the proposed supply could be made, and to continue Dr. Crossland as a committee for examination and report.

The Secretary presented a report upon an additional water supply for the city of Kenton to be obtained from a well located on the Calhoun farm, in Taylor creek valley, about one and one-half miles south of the court house.

On motion of Dr. Gemmill it was unanimously voted to approve said additional supply.

The Board voted to approve a new water supply for Youngstown, previously reported upon and approved by mail vote.

The Board voted to approve a new water supply for Berea, previously reported upon and approved by mail vote.

The Board voted to approve a new water supply for Jackson, previously reported upon and approved by mail vote.

The Board voted to approve plans for a sewerage system for McConnellsville upon the conditions:

a. That an intercepting sewer shall be built to carry all sewage below the dam across the river opposite Lock street, or

b. That the sewage shall be purified in a manner satisfactory to the State Board of Health as the Board may select. Such intercepting sewer or purification works to be constructed whenever it shall be deemed necessary by the State Board of Health.

On motion of Dr. Stanton it was voted to disapprove plans proposed for the sewerage of Lakewood until satisfactory plans should be presented for the purification of the sewage.

The committee, Drs. Warner and Probst, appointed to arrange for the discussion of the prevention of tuberculosis in animals at Farmers' Institutes to be held throughout the state, reported that information as to the places and time of holding such meetings was received too late to secure speakers for all of them. It was voted to arrange for the presentation of this subject at as many of the institutes as possible.

It was moved by Dr. Warner that in the case of epidemics of contagious diseases the Secretary be authorized to employ physicians to assist him in making diagnosis and in instituting proper preventive measures as he might deem necessary. The motion was adopted.

The Secretary presented a report of his investigation of the pollution of the water supply of Wellston.

On motion of Dr. Stanton the report was approved.

The Secretary presented a report of an outbreak of typhoid fever at Corneaut, which he had traced to the pollution of the public water supply. The Secretary reported that he had had a conference with Senator Garfield, who represented the Receiver for the Water Works Company at Corneaut, in reference to providing for purification of the water supply.

Dr. Stanton moved, and it was seconded, that Mr. Horton, the bacteriologist, be appointed to represent the Board at a meeting of the Laboratory Committee of the American Public Health Association, to be held in Minneapolis in October.

Dr. Kahle moved to amend the motion by including Dr. Warner as a delegate of the Board to attend the meeting of the American Public Health Association. The amendment was seconded.

The amendment was adopted and the original motion as amended was also adopted.

The Secretary presented a motion relative to the Spooner Bill, in Congress, for the creation of a National Department of Health.

On motion of Mr. Hartzell the Board voted that it would urge the passage of said bill and the Secretary was instructed to send letters to Ohio's members of Congress favoring its passage.

The Secretary presented a number of amendments to the rules and regulations of the Board governing contagious diseases and the transportation of dead bodies.

The rules and regulations as adopted by the Board are as follows:

RULES AND REGULATIONS OF THE OHIO STATE BOARD OF HEALTH.

ADOPTED JUNE 30, 1893, AMENDED OCTOBER 22, 1896, AMENDED OCTOBER 18, 1899

CONTAGIOUS DISEASES.

Rule 1. No person suffering from diphtheria, membranous croup, scarlet fever [*scarlatina, scarlet rash*], smallpox, measles, whooping cough or other dangerous communicable disease shall be admitted into any public, parochial or private school or college or Sunday school, or shall enter any assemblage, or railway car, street car, vessel or steamer or other public conveyance.

Rule 2. No person shall be admitted into any public, parochial or private school or college or Sunday school from any house or building in which has recently occurred a case of dangerous communicable disease, without first presenting a certificate signed by a reputable physician that all danger of communicating such disease is past, and said certificate is endorsed by the board of health or its proper officer within whose jurisdiction the person may reside or be.

Rule 3. No parent, guardian or other person having charge or control of any child or children, shall allow or permit any such child or children to go from any house or building in which a case of smallpox, diphtheria, membranous croup, scarlet fever [*scarlatina, scarlet rash*], measles, typhus fever or cholera has recently occurred, until such house or building has been properly disinfected, and quarantine has been removed by the board of health or its proper officer.

Rule 4. It shall be the duty of every physician called to attend a person sick, or suspected to be sick, with cholera, yellow fever, smallpox, diphtheria, membranous croup, scarlet fever [*scarlatina, scarlet rash*], measles, whooping cough, typhoid fever or typhus fever, within twelve hours thereafter, to report the name and residence of such person to the board of health or its proper officer, within whose jurisdiction such person is found; and where a person is taken sick with any of the above named diseases, and a physician is not called, it shall in a like manner be the duty of the owner, or the agent of the owner, of the building in which such person resides, lives or is staying, and the head of the family in which such disease occurs, to report the name and residence of the patient to the board of health or its proper officer.

Rule 5. It shall be the duty of the board of health, or its proper officer, when a case of smallpox, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever [*scarlatina, scarlet rash*], or measles is reported within its jurisdiction, to at once place, or cause to be placed, in a conspicuous position on the house wherein any of the aforesaid

diseases occur, a quarantine card or flag and a notice announcing in large letters, "CONTAGIOUS DISEASE WITHIN," or giving in large letters the name of the disease within, and to prohibit entrance to or exit from such house without written permission from the board of health.

Rule 6. Every physician attending a person affected with smallpox, diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*], or typhus fever, shall use every possible precaution to prevent communication of the disease to others.

Rule 7. Any house or building, and its contents, in which a case of smallpox, cholera, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*], or measles has occurred, shall be disinfected by the owner or occupant, under the supervision of the board of health or its proper officer, in the manner recommended by the State Board of Health in its circular on "Disinfection and Disinfectants."

Rule 8. The isolation of patients and duration of quarantine in infectious diseases shall be as follows:

DIPHTHERIA AND MEMBRANOUS CROUP.—For the patient: Isolation for fourteen (14) days after recovery and disinfection of premises. For persons associated with, or in the house with the patient: Adults, quarantine until after death or recovery of the patient and disinfection of premises. Children, quarantine for seven (7) days after disinfection of premises.

SCARLET FEVER [SCARLATINA, SCARLET RASH].—Isolation of the patient and quarantine of children associated with or in the house with the patient for ten (10) days after complete desquamation or scaling of patient and disinfection of the premises.

SMALLPOX.—For the patient: Isolation until after all crusts or scales have fallen off, and the disinfection of the patient's body and the premises. For exposed persons: Quarantine for fourteen (14) days from date of last exposure.

CHOLERA AND YELLOW FEVER.—For the patient: Isolation until after complete recovery and disinfection of the premises. For exposed persons: Quarantine for five (5) days from date of last exposure.

TYPHUS FEVER.—For the patient: Isolation until after complete recovery and disinfection of the premises. For exposed persons: Quarantine for twenty-one (21) days from date of last exposure.

Rule 9. The bodies of persons who have died of smallpox, cholera, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*], puerperal fever, erysipelas, measles or other contagious or infectious disease, shall be wrapped in a sheet saturated with a solution of bi-chloride of mercury or formaldehyd—one ounce to the gallon of water—and shall be buried or cremated within twenty-four hours after death, except by written permission of the board of health.

Rule 10. No public or church funeral shall be held in connection with the burial of a person who has died of cholera, smallpox, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*], measles or whooping cough, and the body of such person shall not be taken into any church, chapel or other public place.

Rule 11. School books or books from a public or circulating library shall not be taken into the house where smallpox, typhus fever, diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*] measles or whooping cough exists. And if school books or library books have already been taken into such house, they must be destroyed by the owner or library authorities, or be properly disinfected before they are again taken to school or placed in circulation.

TRANSPORTATION OF DEAD BODIES.

Rule 12. The transportation of bodies dead of smallpox, Asiatic cholera, yellow fever, typhus fever or bubonic plague is absolutely forbidden.

Rule 13. The bodies of persons dead of diphtheria [*membranous or diphtheritic croup*], scarlet fever [*scarlatina*, *scarlet rash*], shall not be transported in any manner except for burial in the cemetery or cremation in the crematory nearest the place of death, or to the usual burial grounds or crematory for persons dying in such place, unless prepared and shipped in accordance with the following directions:

(a) A permit to transport the body must be first obtained from the board of health where the death occurred, and from the board of health where the burial or cremation is to take place.

(b) The body must be prepared for shipment by being thoroughly disinfected by arterial and cavity injection with an approved disinfectant fluid disinfecting and stopping of all orifices with absorbent cotton, and washing the body with the disinfectant. After being disinfected as above, such body shall be enveloped in a layer of cotton not less than one inch thick, securely wrapped in a sheet, and encased in an air-tight zinc, tin, copper or lead lined coffin, or iron casket, all joints and seams hermetically soldered, and all enclosed in a strong, tight wooden box. Or, the body being prepared for shipment by disinfecting and wrapping as above, may be placed in a strong coffin or casket, and said coffin or casket encased in an air-tight zinc, copper or tin case, all joints and seams hermetically soldered, and all enclosed in a strong outside wooden box.

(c) The health officer or other authorized agent of the board of health of the city, village or township where the death occurred must certify in writing that the body has been prepared in the manner provided above.

Rule 14. The bodies of those dead of typhoid fever, puerperal fever, erysipelas, glanders, anthrax leprosy, tuberculosis or measles, or other

dangerous communicable disease other than those specified in Rules 12 and 13, may be received for transportation when prepared for shipment by filling cavities with an approved disinfectant, washing the exterior of the body with same, stopping all orifices with absorbent cotton, and enveloping the entire body with a layer of cotton not less than one inch thick, and all securely wrapped in a sheet, provided, that this shall apply only to bodies which will reach their destination within forty-eight hours from time of death. In all other cases such bodies shall be prepared for transportation in conformity with Rule 13.

Rule 15. The bodies of those dead of diseases that are not contagious, infectious or communicable, may be received for transportation when encased in a sound coffin or casket and enclosed in a strong outside wooden box, provided they reach their destination within thirty hours from time of death. If the body will not reach its destination within thirty hours from the time of death it must be prepared for shipment by filling cavities with an approved disinfectant, washing the exterior of the body with the same, stopping all orifices with absorbent cotton and enveloping the entire body with a layer of cotton not less than one inch thick, and all securely wrapped in a sheet.

Rule 16. The body of a person dead of diphtheria, [*membranous or diphtheritic croup*], or scarlet fever [*scarlatina, scarlet rash*], may be shipped to Ohio from other states or provinces by permission of the board of health of the city, village or township where the body is to be buried or cremated, provided the body has been prepared in accordance with these regulations, or by an undertaker duly licensed to prepare such by the board of health of the state or province from which the body comes.

Rule 17. In case of contagious, infectious or communicable diseases, the body must not be accompanied by persons or articles which have been exposed to the infection of the disease, unless certified by the health officer as having been properly disinfected; and before selling passage tickets agents shall carefully examine the transit permit and note the name of the passenger in charge, and of any others proposing to accompany the body, and see that all necessary precautions have been taken to prevent the spread of disease. The transit permit in such cases shall specifically state who is authorized by the health authorities to accompany the remains. In all cases where bodies are forwarded under Rule 13 notice must be sent by telegraph to the health officer at destination, advising the date and train on which the body may be expected. This notice must be sent by, or in the name of the health officer at the initial point, and is to enable the health officer at destination to take all necessary precautions at that point; and it is hereby forbidden to open or unseal the coffin, casket or box containing such body, or to in any way expose it to view.

Rule 18. Every dead body must be accompanied by a person in charge, who must be provided with a passage ticket and also present a

full first class ticket marked "corpse" for the transportation of the body, and a transit permit—showing physician's or coroner's certificate, health officer's permit for removal, undertaker's certificate, name of deceased, date and hour of death, age, place of death, cause of death, and if of a contagious, infectious or communicable nature, the point to which the body is to be shipped, and when death is caused by any of the diseases specified in Rule 13, the name of those authorized by the health authorities to accompany the body. The transit permit must be made in duplicate, and the signatures of the physician or coroner, health officer and undertaker must be on both the original and duplicate copies. The undertaker's certificate and paster of the original shall be detached from the transit permit and pasted on the coffin box. The physician's certificate and transit permit shall be handed to the passenger. The whole duplicate copy shall be sent to the official in charge of the baggage department of the initial line, and by him to the Secretary of the State or Provincial Board of Health of the State or province from which said shipment was made.

Rule 19. When dead bodies are shipped by express the whole original transit permit shall be placed upon the outside of the box and the duplicate forwarded by the express agent to the Secretary of the State or Provincial Board of Health of the state or province from which said shipment was made.

Rule 20. Every disinterred body dead from any disease or cause shall be treated as infectious or dangerous to the public health and must not be accepted for transportation unless said removal has been approved by the State or Provincial Board of Health having jurisdiction where such body is to be disinterred, and the consent of the health authorities of the locality to which the corpse is consigned has first been obtained; and all such disinterred remains must be enclosed in a hermetically sealed (soldered) zinc, tin or copper lined coffin or box. Bodies deposited in receiving vaults will be treated and considered the same as buried bodies.

Rule 21. All rules and parts of rules conflicting with these rules are hereby repealed.

QUARANTINE.

Rule 22. No common carrier or other person shall bring into the State of Ohio any person sick or suspected to be sick with Asiatic cholera, smallpox, yellow fever, typhus fever, diphtheria, membranous croup, scarlet fever [*scalatina*, *scarlet rash*], or any other dangerous, contagious or infectious disease.

Rule 23. When any railway car, steamboat, sailing vessel or other conveyance coming from a place or locality declared by the State Board of Health to be infected with cholera, smallpox, typhus fever or yellow fever, or having on board any person or persons affected with any of the above named diseases enters any port or place in the State of Ohio, such

railway car, steamboat, lake vessel or other conveyance, and the crew, officers, passengers, baggage, merchandise and freight shall be subject to such inspection and disinfection as may be ordered by the State Board of Health.

Rule 24. If any person is found on any railway car, steamboat, lake vessel or other conveyance, who is sick with any of the diseases named in Rule 23, he or she shall be removed by the health authorities within whose jurisdiction such person is found, and isolated and properly cared for until the termination of the disease. And the necessary expense of such isolation and care, if the person so removed is unable to pay the same, shall be a valid claim against and be refunded by the owners, agents or assignees of the railway car, steamboat, lake vessel, or other conveyance from which said person or persons were removed.

Rule 25. In case of smallpox, all persons reasonably suspected of having been exposed thereto shall be removed from such railway car, steamboat, lake vessel, or other conveyance, and be isolated for fourteen (14) days from the last exposure. In case of typhus fever, all persons reasonably suspected of having been exposed thereto shall be removed and isolated for twenty-one (21) days from last exposure. In case of cholera or yellow fever, all persons reasonably suspected of having been exposed thereto shall be removed and isolated for five (5) days from last exposure. The clothing of persons so removed, and all baggage, luggage, freight or merchandise found on any railway car, steamboat, lake vessel, or other conveyance, on which there is any person or persons sick with cholera, smallpox, typhus fever or yellow fever, and reasonably suspected of having been infected, shall be disinfected or destroyed, and such railway car, steamboat, lake vessel, or other conveyance, shall be disinfected as required by the board of health.

Rule 26. When deemed necessary by the State Board of Health to prevent the spread of cholera and after ten (10) days' notice, each and every railway car, steamboat and lake vessel in or coming into the State of Ohio, and used for the transportation of passengers, shall be provided with means satisfactory to said board for disinfecting the excreta of passengers and crews.

Rule 27. It shall be the duty of the conductor of any railway train, and of the master of any lake vessel or river vessel to immediately notify by telegram the Secretary of the State Board of Health, at Columbus, of any case or suspected case of cholera, smallpox, yellow fever or typhus fever occurring on board such train or vessel within the limits of the State of Ohio.

Rule 28. It shall be the duty of the board of health or other health authority of any city, village or township, to at once furnish the State Board of Health with a true copy of any quarantine orders or regulations adopted by said board of health or health authority as against any foreign country or state or any municipality or township within the State of Ohio.

NOTE.—The foregoing rules have been adopted by virtue of authority conferred by Sec. 2 of the act establishing the State Board of Health, which provides that: “ * * * The board may make special or standing orders or regulations for the prevention of the spread of contagious or infectious diseases, and for governing the receipt and conveyance of remains of deceased persons. * * * It shall be the duty of all local boards of health, health authorities and officials, officers of state institutions, police officers, sheriffs, constables and all other officers and employes of the state or any county, city or township thereof, to enforce such quarantine and sanitary rules and regulations as may be adopted by the state board of health and in the event of failure or refusal on the part of any member of said boards or other officials, or persons in this section mentioned to so act, he or they shall be subject to a fine of not less than fifty dollars, upon first conviction, and upon a conviction of second offense of not less than one hundred dollars.” * * * (O. L. 90 v. 94; 86 v. 223; 83 v. 77.)

REPORTS.

Rule 29. It shall be the duty of the health officer of every municipal board of health to furnish each week to the State Board of Health a report of all cases of diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*], cholera, typhus fever, yellow fever, typhoid fever, smallpox or measles occurring within his jurisdiction, and to telegraph the Secretary of the State Board of Health, at Columbus, as soon as notified of the existence of a case or cases of smallpox, cholera, yellow fever or typhus fever within his jurisdiction.

Rule 30. It shall be the duty of each municipal board of health to furnish to the State Board of Health on or before the 15th day of each and every month a report of all deaths, with the causes thereof, occurring within the limits of the municipality, during the next preceding calendar month.

Rule 31. It shall be the duty of the superintendent of any state institution and of the superintendent of any county children's home or county infirmary in the State of Ohio, to at once report to the State Board of Health any case of smallpox, cholera, yellow fever, typhus fever, typhoid fever, diphtheria, membranous croup, scarlet fever [*scarlatina*, *scarlet rash*], measles or other contagious or infectious disease occurring in such institution or home, and to furnish the said board on or before the 15th day of each and every month a report of the deaths, and the causes thereof, occurring therein during the next preceding calendar month.

Rule 32. It shall be the duty of all local boards of health, health authorities and officials, officers of state institutions, police officers, sheriffs, constables, and all other officers and employes of the state, or any county, city or village thereof, to enforce the foregoing orders and regulations.

C. O. PROBST, M. D.

Attest:

Secretary.

Mr. Hartzell, who had been appointed to investigate a report that the city of Salem had constructed a sewer without having submitted the outlet of such sewer to the State Board of Health for its approval, as required by law, reported that he had been to Salem and had made an investigation and found that the report was true.

On motion of Dr. Warner the Secretary was instructed to consult the Attorney General in reference to instituting injunction proceedings against the authorities of Salem for having constructed said sewer in violation of the law.

An application for the approval of an additional public water supply for the city of Troy was presented by the Secretary.

On motion of Dr. Kahle it was voted to make an investigation of said supply and Dr. Stanton was appointed a committee for that purpose.

The Secretary presented a copy of an ordinance adopted by the council of Caldwell giving permission to construct a private sewer with the provision that the outlet of said sewer be approved by the State Board of Health.

Dr. Crossland was appointed a committee to investigate and report upon the proposed outlet.

The Secretary presented his annual report, which was approved and ordered filed with the Governor.

On motion of Dr. Kahle, the President and Secretary were requested to arrange a program for a joint meeting of State and Local Boards of Health, to be held in Columbus following the regular January meeting of the State Board.

There being no further business the Board adjourned.

Attest:

C. O. PROBST,
Secretary.

QUARTERLY REPORT OF THE SECRETARY.

To the President and Members of the Ohio State Board of Health:

GENTLEMEN:—As your Secretary I have the honor to submit the following report for the time intervening since the special meeting held in Cleveland, August 16th and 17th, 1899.

It may be well to consider first the smallpox situation.

On August 19th I was called to Lancaster by the health officer to see some cases of smallpox in a family named Litterel. Some of the physicians who had not seen the cases were doubtful, so I was told, of their being smallpox. Many merchants were uneasy about conflicting reports. The board of health wished for instructions regarding the erection of a smallpox hospital or pest house. I visited the cases with the health officer. There were four of them in one family, but no other cases at that time. They were undoubtedly smallpox. Mr. Litterel had confluent smallpox, and died the day after I was there. I met the board of health and gave them full instructions. There have been

reported in Lancaster since that date nine cases. Most of these outbreaks have been untraceable from family to family, which increases the gravity of the situation there.

September 27th, I was called by the township board of health to Hookers, four miles from Lancaster. I found that smallpox had occurred in three families, resulting in twelve cases. The disease began in the first family the latter part of last June, was confined to the children of the family, and was called "chickenpox." The origin of these cases was not positively known, although exposure in Lancaster was suspected. In the third family attacked a young man died three days before my visit from what I must consider, from the description of the case, purpuric smallpox. Another young man in the family, who was taken with a mild attack on August 8th, had subsequently gone to Otterbein College, at Westerville. He had been summoned home, on account of the illness of his brother, but was expecting to return. This family had been quarantined by having a card placed on the house announcing "Contagious Disease Within," but further than this nothing had been done. The young man who went to Otterbein had not had his clothing disinfected. I met a member of the township board of health and gave him proper instructions for dealing with this family. In the two other families attacked, the patients had recovered. They lived in another township. Upon returning home proper instructions for disinfecting these houses and their contents were sent to the board of health; and vaccination of the school children in both townships was ordered. The President of Otterbein was notified to disinfect the clothing left there by the young man who had had smallpox. He was informed that this student, having fully recovered from the disease, might be readmitted upon a proper certificate from the health officer to the effect that his clothing and person had been disinfected. Since my visit there the board of health telephoned me that they had found several children in another family, who had been exposed to the disease these other families were having, sick with an eruptive disease. The board sent a physician to examine them, who reported that they had some unknown form of skin disease, not smallpox. The board nevertheless was instructed to enforce proper quarantine and other preventive measures. There is probably a doubt in the minds of the physicians who had charge of these cases, as well as in the mind of the public, as to their having been smallpox. This may lead to a laxity in the enforcement of preventive measures.

Singularly enough the cases nearest Hooker's are in the same township where the first outbreak of this epidemic began, that is at Carroll, where the disease was first mistaken for black measles, and then called chickenpox.

On September 28th, the next day, I went to the Ohio Soldiers' and Sailors' Orphans' Home, at Xenia, where I found a very well marked case of smallpox in a child who came from the Montgomery County Children's Home, at Dayton, August 31st. He was taken sick Sep-

tember 13th, and was promptly isolated. As nearly all the children of the Home were vaccinated last year, and as vaccination was promptly performed on those who had been since admitted, there is little danger of other cases occurring.

September 29th I went to Dayton and visited the Children's Home with the health officer and attending physician. There had been twenty-two cases at that time in the Home, of what had been called chickenpox. The cases were undoubtedly smallpox, though of mild character. Fortunately they had been kept isolated in a separate building and treated, in most respects, as smallpox. No children had been sent out for some time, and none admitted. Three additional cases have been reported in the Home since my visit.

In the city proper three additional cases have been reported. These are not traceable to the cases in the Home.

October 3rd, the health officer of Springfield called me there to see a case of smallpox. The disease was first diagnosed as syphilis by the attending physician, but two other physicians and the health officer pronounced it smallpox. The case was well pronounced, and I had nothing to do except to sustain the health officer in his diagnosis. This case shows the marked disposition on the part of local health authorities to place the responsibility upon the State Board of Health. The health officer of Springfield is a thoroughly competent physician, experienced in smallpox, and has been health officer for many years.

I should like for the Board to very seriously consider whether it should be the duty of the Board or its Secretary to respond to all demands of this kind from local health authorities.

Since my visit to Springfield the health officer has reported two other cases.

The first case, Leslie Rogers, came from the Montgomery County Children's Home September 7th, and was sick at the time he arrived at Springfield. He went with his mother and two other children to his sisters, who lives above the rooms occupied by Mrs. Cottrell (The case I was called to see October 3rd). The father of the boy went to Springfield September 17th, was taken sick September 27th, but was not seen by the health officer until October 6th, at which time the eruption was well defined. September 27th the truant officer ordered the boy into school and it was not until then that suspicion was aroused of the boy having had smallpox.

Cases of smallpox have been reported since our last meeting as follows:

Addyston one case, Bloom township, Fairfield county, 7 cases; Children's Home at Dayton, 25 cases; Cincinnati 14 cases; Columbus 2 cases; Dayton 3 cases; Greenfield township, Fairfield county, 5 cases; Hamilton 3 cases; Lancaster 17 cases; Margaretta township, Erie county, 1 case; Newburg 1 case; New Carlisle 1 case; New London township,

Huron county, 1 case; O. S. & S. O. Home at Xenia 1 case; Proctorville 18 cases; Springfield 3 cases; Washington township, Hocking county, 1 case, and Youngstown 1 case.

The following circular letter has been mailed to all local boards of health in Ohio:

OHIO STATE BOARD OF HEALTH.

OFFICE OF THE SECRETARY,

COLUMBUS, OHIO, October 1, 1899.

To Boards of Health of Ohio:

We wish to direct your attention to the matter of smallpox, from which our state has not been free since the first outbreak of the recent epidemic in April, 1898. Since that time 2,137 cases were reported in Ohio with 32 deaths. From January 1, 1899, to the present date, there have been 1,468 cases and 27 deaths. Smallpox has prevailed more or less extensively this year in the following states:

Alabama, California, Colorado, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia and Wisconsin. The disease has appeared in some other states, but has not prevailed to any great extent. With but few exceptions the disease has been of the same mild character in these states as in Ohio.

In spite of the best efforts of the health authorities, state and local, smallpox has maintained itself in Ohio during the summer months, the season least favorable to the spread of the disease. There is great probability that smallpox will again assume epidemic proportions during the coming winter, for the following reasons:

First, The number of cases that have occurred which were not discovered by the health authorities until after the patients had recovered, thus permitting numerous but unknown exposures to the disease.

Second, The general neglect of vaccination and revaccination, so that in all communities a majority of the inhabitants are unprotected against the disease.

Third, The epidemic tendency of the disease and its prevalence throughout the United States.

Fourth, The exceedingly mild character the disease has manifested thus far. This operates in many ways to favor its spread. The symptoms are so modified, that in many cases, physicians with considerable experience with smallpox have been deceived in the diagnosis. In some cases the disease has been so mild that no physician has been called. When the board of health enforces rigid quarantine measures in these

mild cases many hold quarantine in greater dread than the disease, and do all in their power to conceal cases occurring in their families. The people, not having their usual dread of smallpox, are careless about exposure and neglect or refuse vaccination.

We have no assurance that smallpox during the coming winter will maintain this same benign character. It requires long periods of time for a disease to become *permanently* so modified, and the change is a *gradual* one. As recently as 1893-4, however, in the Chicago epidemic, nearly one-third of the victims died.

Boards of health throughout the state are urged to make preparations *now* for dealing with the first outbreak of smallpox in their respective communities. The disease is easily and *cheaply* suppressed if first cases are promptly and rigidly dealt with. An epidemic of the disease, no matter how mild in form, with the expense of quarantine, etc., and especially the loss in business, is a very expensive, and annoying if not dangerous thing. Boards of health and physicians, therefore, by prompt action in first cases, have it in their power, not only to protect the health of their communities, but also their business interests. The worst possible policy, often urged by business men, is an attempt to conceal the presence of smallpox. By so doing it is difficult and usually impossible to enforce sufficiently rigid measures and the disease becoming established and finally known, will injure the community's prosperity for months, instead of weeks.

The following recommendations are made to local boards of health:

1. Call an early meeting of the board and carefully consider the action to be taken should a case of smallpox be reported within your jurisdiction.
2. If possible secure an option for the purchase or rental of a suitable house for a quarantine hospital. If this is impossible, select a place where one could be established on short notice.
3. Make a list of suitable persons who are willing to act as guards or nurses.
4. Arrange with some experienced physician to serve you as a consultant in the diagnosis of doubtful cases, if your health officer is not a physician, or has not had experience with smallpox.
5. Endeavor in all possible ways to secure vaccination and revaccination of all susceptible persons in your community. If your newspapers can be induced to urge vaccination this will be a great aid to this end. The vaccination of all children attending public or parochial schools should be made compulsory.

The board of health has authority to order vaccination of school children whenever smallpox invades or threatens to invade its community; and the board of education may at all times enforce such a rule. It would be advisable for a joint conference to be held between the board of health and board of education to consider measures to be taken to

secure vaccination of school children. Managers of factories and workshops, hotels, etc., should be urged to have their employes vaccinated, to prevent the necessity of temporarily stopping or restricting their work should smallpox develop and a number of unprotected workmen be exposed.

The rules of the State Board of Health for the prevention of smallpox, which the law makes it the duty of your board to enforce, are enclosed herewith. The rule requiring cases of chicken-pox to be reported, and houses containing such cases to be carded, should be strictly enforced. In the majority of places in Ohio where smallpox has recently prevailed, the first cases were mistaken for chicken-pox, and it was because of this mistake that the disease had an opportunity to spread. All severe cases of chicken-pox should be investigated by the board of health; and it is to be remembered that *chicken-pox in adults is an exceedingly rare disease*.

The State Board of Health should be *immediately* notified of the first appearance of smallpox, and will lend every possible assistance in its prevention.

Very respectfully,

C. O. PROBST, M. D.,
Secretary.

As the question of compulsory vaccination comes before me with great frequency, I submitted the matter to the Attorney-General in the following communication:

COLUMBUS, OHIO, September 18th, 1899.

Hon. F. S. Monnett, Attorney General, Columbus, Ohio:

DEAR SIR:—Will you please inform me whether, in your opinion, a board of health has authority to make and enforce an order that no child shall be permitted to attend a public or parochial school without having been successfully vaccinated. In this connection I wish to inform you that Ohio has been suffering with an epidemic of smallpox during the past eighteen months or more, and that the disease is still present in several communities of the state. It is also prevailing to a considerable extent in other and adjoining states, and there is reason to fear that we shall have another epidemic of the disease to contend with during the coming winter. I therefore wish to know, first, whether in consideration of these facts a board of health of a city, village or township where smallpox is actually present has authority to enforce such a rule.

Yours truly,

C. O. PROBST,
Secretary.

He replied as follows:

COLUMBUS, OHIO, September 20th, 1899.

Hon. C. O. Probst, Secretary of the State Board of Health, Columbus, Ohio:

DEAR SIR:—This department had the honor to receive a communication from your office, under date of September 18th, 1899, asking for a written opinion upon certain propositions therein set forth to wit:

First, whether in consideration of the facts in your communication narrated, boards of health of Ohio would have authority to enforce an order requiring vaccination of school children.

Second, whether a board of health of a city, village or township where smallpox is actually present has statutory authority to enforce such a rule.

In the data and preamble of these inquiries you inform the department that Ohio is now and has been suffering in many portions of the state with an epidemic of smallpox for more than eighteen months past, and that the disease is still present in several communities of the state, and that the disease is still prevailing to considerable extent in other and adjoining states; that there is well grounded reason to fear that the citizens of this state will have another epidemic of the disease to contend with during the coming winter.

As I have stated to you in former opinions in reference to the powers of the health board, both state and local, they have been delegated to your respective boards by the Legislature, and the Legislature obtained its right and power through the Constitution, and the courts, both state and federal, have from time to time sustained many of these powers so granted to health boards under the police clause of the constitution of the respective states. The constitutional clause relied upon by the courts is usually found in the preamble and bill of rights and based upon the fundamental principle, that the purpose of government is to promote the common welfare and to preserve life and protect property and obtain happiness and safety.

The powers so vested in the Legislature by the constitution have been exercised in the state of Ohio under the various acts creating and delegating powers to all boards of health, both state and local.

Section 2, of the act (90 O. L. 94) in broad terms delegates to the State Board of Health the supervision of all matters relating to the preservation of the life and health of the people of the state. Among such powers it especially provides:

“The Board may make special or standing orders or regulations for the prevention of the spread of contagious diseases or infectious diseases, * * * and such other sanitary matters as admit of and may best be controlled by a universal rule; * * * it may also make and enforce orders in local matters when an emergency exists and the

local board of health has neglected or refused to act with sufficient promptness or efficiency. * * * It shall be the duty of all local boards of health, health authorities, officials, officers of state institutions, police officers, sheriffs, constables and all other officers or employes of the state, county, city or township thereof, to enforce such quarantine and sanitary rules and regulations as may be adopted by the State Board of Health, and in the event of failure or refusal on the part of any member of said boards or other officials * * * they shall be subject to a fine of not less than \$50 upon conviction, and upon two offenses not less than \$100. The board of health shall make careful inquiry as to the cause of disease, especially when contagious, infectious, epidemic, or endemic and take prompt action to control and suppress it."

Section 2116 (O. L. 90, p. 88) gives further directions by statute to the local board in words as follows:

"And when complaint is made, or a reasonable belief exists, that an infectious or contagious disease prevails in any house or other locality, the board may cause such house or locality to be inspected by its proper officers, and on discovering that such infectious or contagious disease exists, may, as it deems best, send persons so diseased to the pest house or hospital, or may restrain them and others exposed within said house or locality from intercourse with other persons, and prohibit ingress or egress to or from such premises."

Sections 2129 and 2137 provide for penalties for the disobedience of the orders of the boards of health so made.

In addition to said general powers so named, Section 2135, (90 O. L. p. 91) provides that the "board of health may take measures and supply agents and afford inducements and facilities for gratuitous vaccination, and may furnish disinfectants and enforce disinfection. It may afford medical or other relief to and among the poor of the corporation as in its opinion the protection of the public health may require, and during the prevalence of any epidemic may provide temporary hospitals for such purposes; and the said board is hereby required to inspect semi-annually, and oftener if in the judgment of the board it shall be deemed necessary, the sanitary condition of all schools and school buildings within its jurisdiction, and may, during an epidemic or threatened epidemic close any school, and prohibit public gatherings for such time as it may deem necessary."

The standard work on Public Health and Safety by Parker and Worthington, Section 123 states:

"It is sometimes provided by law that persons who may have been exposed to contagion, or who came from places believed to be infected, and particularly children attending the public schools, shall submit to vaccination, under the direction of the health authorities. This requirement is a constitutional exercise of the police power of the state, which can be sustained as a precautionary measure in the interest of the public

health. But as incidental to their general powers relating to the prevention of contagious diseases the health authorities have the right to prescribe regulations with reference to vaccination, and they may require vaccination whenever, in their judgment, the interest of the public health will be thereby subserved. To this end they are authorized, and even directed to provide a suitable supply of fresh vaccine virus, of a quality in their judgment proper and reliable, and to furnish the means of thorough and safe vaccination to all persons who may need the same, and without charge to such persons as are unable to pay for the same."

In the case of *Abell v. Clark*, 84 Cal. 226, the court says in passing upon the statute governing the subject of compulsory vaccination:

"The Legislature has power to enact such laws as it may deem necessary, not repugnant to the constitution, to secure and maintain the health and prosperity of the state, by subjecting both persons and property to such reasonable restraints and burdens as will effectuate such objects.

"It is for the Legislature to determine what is for the public good, and what are necessary and salutary burdens to impose upon a general class of persons to prevent the spread of disease, and its discretion cannot be controlled by the courts, if its action is not clearly evasive and unlawful, under pretense of lawful authority."

This was passing upon an act of 1891 which provided for the vaccination of all children attending the public school and for the exclusion of the unvaccinated children therefrom. The Court further stated:

"The act referred to is designed to prevent the dissemination of what, notwithstanding all that medical science has done to reduce its severity, still remains a highly contagious and much dreaded disease. While vaccination may not be the best and safest preventative possible, experience and observation, the test of the value of such discoveries, dating from the year 1796 when Jenner disclosed to the world, has proved it to be the best method known to medical science to lessen the liability to infection with the disease.

"This being so, it seems highly proper that the spread of smallpox through the public schools should be prevented or lessened by vaccination, thus affording protection both to scholars and the community.

"Vaccination, then, being the most effective method known of preventing the spread of the disease referred to, it was for the Legislature to determine whether the scholars of the public schools should be subject to it, and we think it was justified in deeming it a necessary and salutary burden to impose upon that general class."

The importance of the question herein submitted and the interference with private rights by harsh enforcement of the rules laid down by other states prompts me to furnish the above details and authorities for your reference.

The general powers given to the State Board seem, standing apart from the subsequent modifications of Section 2135, to be comprehensive enough to answer your first inquiry in the affirmative, viz: that they have the authority to enforce an order requiring vaccination of school children or any other citizens whose occupation or profession is such as would spread the disease if affected thereby. But the Legislature seems to have modified the broad terms given to the State and local boards in other sections by Section 2135 in applying the rules to vaccination and in using the language therein, viz: "That the board of health may take measures and supply agents and afford inducements and facilities for gratuitous vaccination and may furnish disinfectants etc." In connection with the remaining part of the section, when properly construed, I hold to vest in the State Board the power to issue orders to the local boards of cities, villages and townships to enforce vaccination where smallpox is actually present, but I do not believe the authority has been expressly granted in view of this limitation to enforce an order requiring vaccination of school children without immediate and imminent danger of epidemic or threatened epidemic, the power being given to such board to close such school and prohibit gatherings for such time as the Board may deem necessary. This power seems to be given rather as an alternative than one that the board of health should resort to whenever the same will afford the necessary precaution and in the immediately infected districts, may take measures for gratuitous vaccination.

In addition to the above statutes, Section 3986 provides for boards of education, enforcing certain rules and regulations, to secure the vaccination of, and to prevent the spread of smallpox among the pupils attending such schools.

Your inquiry did not extend to your powers to be exercised in connection with the school boards, and I have not entered into that discussion.

Respectfully submitted,

F. S. MONNETT,
Attorney-General.

COLUMBUS, OHIO, October 2nd, 1899.

Hon. F. S. Monnett, Attorney General, Columbus, Ohio.:

DEAR SIR:—I have the honor to acknowledge the receipt of your communication of the 20th September in reference to powers of boards of health to require children attending public and parochial schools to be vaccinated.

Will you please inform me whether Section 3986 of the Revised Statutes authorizes the board of education to require all children attending public schools to show evidence of having been satisfactorily vaccinated; and what means such a board may properly take to enforce such an order?

If the board of education should prohibit unvaccinated children from attending a public school, could a parent, who refused to comply with this order by having his child vaccinated, be punished under the truant laws?

Yours truly,

C. O. PROBST,
Secretary.

He replied:

COLUMBUS, OHIO, October 4, 1899.

Dr. C. O. Probst, Secretary of State Board of Health, Columbus, Ohio:

DEAR SIR:—This department has the honor to receive a further communication from your Board in reference to the construction to be given to Section 3986 of the Revised Statutes.

This statute provides:

“The board of each district may make and enforce such rules and regulations to secure the vaccination of, and prevent the spread of smallpox among the pupils attending or eligible to attend the schools of the district, as in its opinion the safety and interest of the public requires; and the boards of health and councils of municipal corporations, and the trustees of townships, shall, on application of the board of education of the district, provide at the public expense, without delay, the means of vaccination to such pupils as are not provided therewith by their parents or guardians.”

As I indicated in my former communications, the Legislature has vested in the boards of each district, as therein stipulated, a wide discretion and all such necessary rules and regulations that they may see fit to regularly adopt and to secure the vaccination of and prevent the spread of smallpox as therein given. The limitation seems to be only that the safety and the interest of the public may require it.

In further answering your inquiry as to the power of the school boards to enforce such order I cannot but repeat the specific grant of power set forth in the statute, viz.: that if the safety and interest of the public require it, such board may demand that all children shall show evidence of vaccination. It is a fair rule of construction to state that the board must have the inherent power to carry out the duty imposed upon them. Such board would have the power to make a rule or regulation covering the subject matter viz: to prevent the spread of smallpox and such rule could include the prohibition of attendance to the public school by such unvaccinated pupils. The power thus granted to one board representing the state for that purpose, to wit: the school board would be a sufficient defense and protection against arrest for a violation of the truant law. In the absence of more definite legislation I can suggest no other remedy or safely construe the language of the statute so as to vest in the board other powers than above stated.

Respectfully submitted,

F. S. MONNETT,
Attorney-General.

You will notice the continued prevalence of smallpox in most of the United States, and there would seem to be every probability that the conditions of last winter will be repeated. I should be glad to have the Board consider whether any further action in the matter should be taken at this time.

I wish to say that if another general epidemic prevails, and if the Board is to personally look after each outbreak, that it will be practically impossible for the Secretary to personally look after the cases and carry on the other work of his office.

I also have to present reports upon the following investigations made by the Secretary:

September 1st I went to Kenton to inspect the source of a proposed additional water supply for that city.

September 6th I went to Wellston to inspect a slaughter house said to be polluting the water supply of that city.

I reported to the Board the results of an investigation of a new water supply for Jackson, made September 5th.

By the request of the board of health of Warren, I visited the Trumbull County Infirmary on September 12th. Most of the members of the Warren Board and Mr. Snow, Engineer, went with me. It will be remembered that our Board approved plans for purifying the sewage of this institution, prepared by Snow and Barbour. One of the conditions of approval was that there should be no overflow for crude sewage into the small creek which was to receive the purified effluent. The Warren board of health were under the impression that this overflow had been put in.

Further opportunities for polluting this creek came from hog lots adjacent to it, the creek itself affording water for the hogs. As this creek, after a short flow ($1\frac{1}{2}$ to 2 miles) enters the Mahoning river about the same distance above the point where water is taken from the river to supply Warren, the board of health of Warren has brought suit against the County Commissioners for the removal of this source of pollution of the city's water supply. The State Board of Health had been requested to assist in furnishing evidence of the alleged pollution. I found on investigation, that there is no overflow for crude sewage into the creek in question. The purification plant was in good condition and seemed to be working properly. The constructing engineers had been having frequent examinations of the effluent made, and according to figures produced by Mr. Snow, the effluent was lower in bacteria and organic impurities than the average for the Mahoning river, as shown by the examinations of the river made by the State Board of Health.

The filthy hog lot had been filled and purified, although hogs were still permitted to wallow in the creek. The creek, however, was practically dry, except for the sewage effluent, which disappeared a little distance from the infirmary.

I informed the Warren board of health that if they desired our assistance we would have samples of the creek water examined above and below the infirmary, and samples of the Mahoning river water above and below the outfall of the creek. This could only be done when the creek is flowing.

Nothing further has been done in the matter, so far as I know, and it is not improbable that the board of health will abandon its suit on account of the improvements that have been made at the infirmary.

On September 19th I visited Lorain on the joint request of the board of education and board of health. A new school house had just been constructed by the board of education and the plumbing in the building did not meet with the approval of the board of health. The plumbing consisted of two series of range water closets in the basement, emptying to the sewer. No provision had been made for back venting the traps and the board of health insisted upon this being done. I visited the school house with the board of health and board of education, and secured from the architect a drawing showing the arrangement of the plumbing. The following communication was sent to the board of education, and a copy of it to the board of health:

COLUMBUS, OHIO, *October 3, 1899.*

To the Board of Education, Lorain, Ohio:

DEAR SIR: On account of illness and absence from home I have been delayed in giving you an answer to the question submitted to me, viz.: the necessity for providing a back vent for the closet traps in the Bank street school building in your city.

The rules of good plumbing require that all traps under fixtures, (water closets, washstands, etc.), shall be provided with an air pipe, the so-called back vent, to prevent the trap becoming unsealed by syphonage.

In my judgment the two closets in this school building should be back vented by a pipe not less than three inches in diameter, which should extend from the crown of the trap on the sewer side of the trap, and either be carried through the roof, increasing the pipe above the roof to four inches, or be carried into the stack now used for the closet vent to a point at least four feet above the opening of such closet vent. Either plan will accomplish the purpose.

I return the sketch you gave me, and have indicated in red ink where these back vent pipes should start from the trap. If, as was stated, the plumbing in all your school houses is on the same plan as that of the Bank street building, I would urge that the same change be made in all of them.

Respectfully,

C. O. PROBST,
Secretary.

Plans for approval of water supplies or sewerage from the following places have come before the Board by mail since the last meeting: For water supply, Dennison, Youngstown, Jackson, and Berea, and for sewerage, McConnelsville and Lakewood.

The improvement proposed for the water supply of Dennison and Uhrichsville was approved with the following provisions:

a. That not less than four filters of the size shown in the specifications be installed at this time.

b. That a thirty days' trial of the filters shall show the bacterial efficiency stated in your proposal, and that the filtered water shall not show the presence of alum.

c. That the plant shall be continuously operated so as to furnish water satisfactorily purified, as determined by the State Board of Health.

The new water supply proposed for Youngstown was approved subject to the following conditions:

a. That the stored waters of Mill creek shall not be used as a source of public water supply without adequate purification.

b. That the purification plant shall show, during a reasonable trial period, a bacterial efficiency of 98 per cent removal without the appearance of alum in the filtered water; such tests to be made as the State Board of Health may require.

c. That the chemical and bacteriological laboratory be made a part of the plant and that the filtered water be properly examined daily so long as Mill creek is made use of as a public water supply.

The new water supply proposed for Berea was approved with the following conditions:

a. That the water shall not be used for domestic purposes from either source unless purified to the satisfaction of the State Board of Health.

b. That in case the village shall decide to make use of the water for fire and purposes other than domestic purposes, an ordinance shall be passed by the village council prohibiting the use of the water for domestic purposes.

c. That completed plans for purification of the water shall be presented to the State Board of Health for approval whenever it shall be decided to use the water for domestic purposes.

The new water supply for Jackson to be obtained from a series of drilled wells was approved without condition.

The plans for sewerage for McConnellsville were approved subject to the following conditions:

a. That an intercepting sewer shall be built to carry all sewage below the dam across the river opposite Lock street, or

b. That the sewage shall be purified in a manner satisfactory to the State Board of Health, as the Board may select, such intercepting sewer or purification works to be constructed whenever it shall be deemed necessary by the State Board of Health.

The plans proposed for sewerage for the hamlet of Lakewood were disapproved, and a request made for more definite information regarding plans for purification of the sewage.

The investigation of the Muskingum river is going on. The monthly analyses will be made in November and possibly in December.

The engineer has completed his field work in fifteen and a half counties. There remain to be examined all of four counties and parts of four others, forming a part of the watershed of the Muskingum river. He has visited the following towns having water works and sewerage and obtained the necessary data for making up his share of the report upon the condition of this river; Shelby, Mansfield, Ashland, Perrysville, Wooster, Wadsworth, Orrville, Massillon, Canton, Louisville, Mineral Point, Minerva, Shreve, Carrollton, Barberton, Cadiz, Waynesburg, Canal Dover, New Philadelphia, Uhrichsville, Dennison, Scio, Cambridge, Mt. Vernon, Coshocton, Piedmont. There remain to be visited, Millersburg, Newark, Zanesville and Marietta.

In addition to the above towns every city and village of any importance in the list of counties given as completed, has been visited, and any source of pollution noted. Two hundred and eighteen such places were visited.

The daily readings of the flowage of the Scioto, Olentangy and Sandusky rivers are being regularly made. Recently, with the assistance of the Assistant Hydrographer of the United States Geological Survey, meter readings of the Maumee and Sandusky rivers were made by the engineer.

In closing I would recommend that provision be made for the usual joint meeting of the State and local boards of health following the January meeting of the Board.

Respectfully submitted,

C. O. PROBST,
Secretary.

CONTAGIOUS DISEASES.

REPORT OF AN INVESTIGATION OF SMALLPOX AT CLEVES.

To the State Board of Health:

GENTLEMEN:—In compliance with the request of the Secretary to inspect cases of reported variola near Cleves, a village on the C. C. C. & St. L. R. R., seventeen miles west of Cincinnati, I have to report that I visited that place on March 10th and found that at the house of Lafayette Graham, in Whitewater township, one mile and a half west of Cleves, there had been five cases of smallpox and two other cases presenting all the subjective symptoms of that disease, but having no eruption. The first case was that of Hayes Graham, a son of Mr. and Mrs. Graham, who works on the Big Four R. R. at the Grand Central Depot in Cincinnati. On February 15th, he was taken sick in this city with headache, muscular pain and fever. As he was too sick to work he went to his father's house where he was attended for three days by Dr. O. J. Wood, of North Bend. On the third day the patient was so much better that Dr. Wood thought him convalescent and discontinued his visits, requesting the family to notify him if his services were again necessary. On the next morning Graham broke out with an eruption that lasted for several days. Dr. Wood was not notified of the appearance of the eruption and has not seen the man since he discontinued his visits—February 18th. After March 1st, Graham came to the city daily on the trains of the Big Four road and returned to his father's house in the evening until March 6th, when he resumed work at the Grand Central Depot.

Lulu Graham, a sister of Hayes Graham, was taken sick March 2nd with chill, fever, headache and pain in the back. On Sunday, March 5th, an eruption appeared first and most free on the face and temples, some on the hands (dorsal and palmar surfaces) a few on the body and three in the mouth. The eruption was at first papular, then vesicular and at the time of my visit, March 10th, was pustular. Some pustules were umbilicated, but umbilication was not marked. Dr. Wood was called to see the case after the appearance of the eruption and at once diagnosed it as variola and reported it to the trustees of Whitewater township, who at once ordered the house placarded, but no quarantine was established. Neighbors visited the Grahams and members of the Graham family went to Cleves. A woman who had been staying at Grahams for some time took her clothing and went to Cleves, where she still remains.

The next member of the Graham household to be taken sick was Mrs. Graham, who for two days had headache, backache and fever, with

a temperature of 103, but no eruption appeared, the symptoms gradually subsided. Mr. Graham presented about the same train of symptoms, beginning a little later.

Millie and Birdie Graham, the two youngest members of the family, were not at any time sick enough to make any complaint, but the characteristic eruption appeared on both and was running the same course as in the other cases.

Edgar Graham, a grandson of Lafayette Graham, who made his home with his grandparents, had headache, backache and a temperature before the eruption of 101. He was taken sick Monday morning, March 6th and the eruption appeared on Friday evening.

The persons here referred to constitute the Graham family. All had the smallpox eruption except Mr. and Mrs. Graham. None of them had ever been vaccinated. All who had the disease had it in a very mild form, but the symptoms and character of the eruption leave no doubt in my mind of the character of the disease.

After visiting Grahams, I returned to the village of Cleves, where I met the board of health of that village and the trustees and clerk of Whitewater township. Full directions were given in regard to vaccination, quarantine and disinfection and both boards assured me that they would go to work at once with the determination of preventing the spread of the disease. The school boards are to be asked to enforce vaccination of the school children and general vaccination is to be urged upon those of all ages. It is impossible to say who have been exposed to the disease and who have not, and nothing but general vaccination will prevent the disease from becoming very prevalent.

I have called the attention of the health authorities of Cincinnati to the case of Hayes Graham and on Monday morning will have a conference with Health Officer Tenney as to what shall be done to prevent the spread of the disease among the railroad employes and others who have been exposed by Graham's carelessness.

I will report further upon this outbreak should anything important develop.

It was reported that there was one case of smallpox in the Vergis family, who live near Grahams, but at the time of my visit there was no one sick there.

Very respectfully,

BYRON STANTON.

Cincinnati, Ohio, March 11th, 1899.

REPORT OF AN INVESTIGATION OF TYPHOID FEVER AT CONNEAUT.

To the State Board of Health:

GENTLEMEN:—The health officer of Conneaut, under date of September 18th, reported an unusual prevalence of typhoid fever in the vil-

lage, and requested assistance in finding the cause thereof. Accordingly, I went to Conneaut on Sept. 20th and have to report as follows:

Conneaut is a village which had a population of 6000 in 1890. The place has been growing rapidly in the last few years, being one of the chief lake ports for the receipt of ore and coal. A public water supply was introduced in 1890 by a company controlled by residents of New York state. The company contracted with the city to furnish water "ample for all the wants of a place of ten thousand inhabitants; the water shall be taken from Lake Erie or from filtering galleries, wells or reservoirs built on the shore of said lake; in either case, in such manner as shall furnish a complete and ample supply of good, pure water as aforesaid; and if taken directly from the lake, the water so taken shall be filtered or clarified in settling basins, in such manner as shall make the same pure, clear and wholesome, and no reservoirs, other than those situated near the shores of said lake, including the one from which water is pumped and the standpipe shall be used in the operation of said works; and the water shall be taken at a point not less than two thousand (2000) feet westerly of the west pier at Conneaut harbor." The pumping plant was located about 1500 feet west of the mouth of the Conneaut river, on the shore of Lake Erie. In the beginning the supply of water was obtained from a series of driven wells put down along the beach near the pump house. Within two years these wells failed to supply a sufficient supply of water and had to be abandoned. For emergencies, as for large conflagrations, a ten inch intake pipe was extended into Lake Erie about 360 feet from a gate house between the pump house and the lake. This was put in when the works were built, but there is no evidence to show that it was made use of, at least to any considerable extent, until some years afterwards. The lake end of this pipe is turned upward, and is at present in about 19 feet of water.

After the abandonment of the driven wells, seven "Cook wells" were put in just east of the pump house. These are six inch pipes forced obliquely under the sand forming the lake bottom, perforated with fine slits, of No. 6 standard size. The wells extend into or rather under the lake for a distance of twenty feet and have from 4 to 5 feet of sand over them. The water forced into these Cook wells packs the sand tightly about them, clogging their openings, and cutting off their yield. This is overcome to a large extent by allowing the water to flow back from the standpipe through these wells or tubes which loosens up the sand around them. This back flushing of the wells is required every few days.

Until within the last few years these wells furnished sufficient water, and it was unnecessary to use the auxiliary supply from the lake. The quantity of water pumped has been gradually increasing, however, and markedly so within the last year. During the summer of this year it is estimated that an average of about 700,000 gallons have been pumped daily reaching a maximum of a million gallons on some days. To furnish

the extra supply it has been necessary to draw on the lake. The lake inlet during this time has been made use of two or three times a week, according to the statement of the engineer.

As bearing on the possibility of the pollution of this lake supply, which has been so frequently drawn upon during the past summer, the sewerage system of Conneaut should be considered.

What is known as Sewer District No. 1, was sewered in 1892-3, before the passage of the act requiring the State Board of Health to approve the plans of all public sewers. This sewer serves the main part of the city, probably three-fourths of the population, and the city engineer estimates that fully 50% of that population has sewer connections. It is built upon the separate system; the outfall sewer discharges into the Conneaut river two miles from the river's mouth, just below the line of usual slack water. The river in dry weather has but a small flow, and at the sewer's mouth is nearly stagnant. The stream at this point is already badly polluted, and is a source of complaint by the operators and employes of a large brick works located nearby.

To describe the conditions a little more accurately, although this does not affect the question, it should have been stated that sewer No. 1, empties into what is known as the "slip", an artificial channel for part of its course, the river proper making a detour and emptying into the slip below the mouth of this sewer.

Sewer District No. 3, serves what is known as the "Harbor". This includes the rapidly growing part of the village near the lake, inhabited mostly by the working classes who are largely foreigners. This sewer, not yet finished, was begun about 1895, and the plans for its construction were not submitted to the State Board of Health for approval as required by law. There are at present but a few house connections. A temporary outlet has been established just below where the river enters the slip.

It may be mentioned in passing, that it was stated that the water-works company refused to furnish water for operating the flush tanks provided for flushing the sewers. Complaint was also made by the village that proper fire protection had not been maintained. These, and perhaps other reasons, led the village to refuse to pay the rentals. The company is now in the hands of a receiver, Mr. F. C. Howe, of the firm of Garfield, Garfield and Howe, of Cleveland, Ohio.

Another source of pollution of the lake water remains to be mentioned. In the harbor there are some low lands draining to a swale carrying surface water to the beach just west of the pump house. When the flow is small this sinks away into the sandy beach, but heavy rains carry this surface drainage to the lake. In winter, when the lake shore is banked with ice, this flows eastward over the Cook wells. These lowlands receive considerable privy and other foul drainage of a dangerous character.

It was impossible to learn the actual number of consumers of hydrant water. The superintendent of the waterworks company stated that there were about 750 taps in use. In the Harbor many families are supplied from one tap. It is doubtless safe to say that the majority of the inhabitants of Conneaut use hydrant water.

Before considering the typhoid epidemic it may be stated that ice is cut from the Conneaut river below the mouth of Sewer No. 1. It can scarcely escape being dangerously polluted. It is mostly sold, I was informed, to vessels. Ice is also cut from what is known as the Curtiss pond. It is filled by surface water and receives considerable undesirable drainage.

A meeting was held soon after my arrival, attended by ten or eleven physicians of Conneaut. All of them had attended typhoid fever patients. The location of their cases, as pointed out on a map of the village, showed that they had not been confined to any one part of it. All agreed that with but few exceptions their patients were users of hydrant water. Along with cases of unmistakable typhoid fever of the usual duration were many cases of continued fever, lasting ten to fourteen days, which some of the physicians were inclined to consider not true typhoid.

From their statements I learned that Conneaut has been practically free from typhoid fever for about eight years prior to the present outbreak. This period corresponds to the time a public water supply has been largely used; and, as you will have noted, is the period during which lake water was *not* being directly made use of. Prior to the introduction of waterworks, when wells were wholly depended upon, Conneaut usually suffered from typhoid fever in the falls during unusually dry seasons.

The health officer, at my request, and after my departure, made a further investigation of the cases reported, and was able to furnish the following information: The disease began in April. There were 12 cases and 2 deaths in April and May; 8 cases and 2 deaths in June; 3 cases and 1 death in July; 66 cases and 6 deaths in August and September; and 5 cases and 1 death in October to the 5th. This makes in all 94 cases and 12 deaths. All but about ten of the patients were using hydrant water. The health officer states "as near as I can learn none of the patients were using ice water. The west end of the town where wells are used almost exclusively has been *entirely* free from typhoid." There was no evidence favoring the view that the disease was communicated through the milk supply.

On Sept. 22, the health officer collected a sample of water from the Conneaut river above all sources of local contamination and another from the river or "slip" near the lake, and below the mouths of the sewers in Districts 1 and 3. The results of the examination were as follows:

REPORT OF CHEMICAL EXAMINATION OF SAMPLES COLLECTED AT CONNEAUT,
SEPTEMBER 22, 1899.

No. 718 sample from Conneaut river above town, No. 719 sample from river below town.

PARTS PER MILLION.

Number of sample.	718	719
Color .....	.21	.13
Turbidity	very slight	distinct
Sediment	slight	slight
Odor	none	faint musty
Oxygen required.....	3.63	2.78
Nitrogen as free ammonia.....	.007	.052
Nitrogen as albuminoid ammonia.....	.140	.105
Nitrogen as nitrates.....	.04	.05
Nitrogen as nitrites.....	.004	.026
Chlorine	4.9	5.3
Alkalinity	92.6	101.4
Incrusting constituents.....	15.0	11.6
Total solids.....	253.	179.
Volatile and combustible	90.	70.

The results show that the river above Conneaut is polluted by matters mostly of vegetable origin, as would be expected. The marked increase in chlorine, and nitrogen in the form of free ammonia and nitrites in the sample from below town, show the effects of sewage pollution. The river where this lower sample was taken is much diluted with lake water which would reduce these figures showing sewage pollution.

BACTERIOLOGICAL EXAMINATION.

Samples were collected from the river at the same points for bacteriological examination. Also from a fire hydrant near a dead end, and from two wells. One of these, the "Fenn well," had been used by eight persons, five of whom contracted typhoid fever, one of them dying. The other, the "McDowell well", was used by six persons, two of whom had typhoid fever. At the request of one of the physicians of Conneaut, a sample of the city water which had passed through a N. A. Watson house filter was examined. The results of these examinations were as follows:

CONNEAUT WATER, OCTOBER 9, 1899.

- 718 River above town; 513 bacteria per c. c. colon.
- 719 River below town, 1155 bacteria per c. c. colon.
- 720 City water filtered through a N. A. Watson filter at the house of Wm. Heyers, 4 bacteria per c. c., no colon.
- 721 City water, dead end, fire hydrant, 12060 bacteria per c. c. colon.
- 722 F. H. Fenn's Sandusky well, 1650 bacteria per c. c. suspicious.
- 723 McDowell well, 10810 bacteria per c. c. colon.

At the time of my visit no water was being pumped from the lake direct. The wind was in a direction to carry the river water enter-

ing the lake to the east, away from the water works intake. I was told that with the wind from the north and especially from the north-east, the colored river water could be plainly seen making its way westward far beyond the waterworks intake pipe. I therefore requested the health officer to furnish me samples of the city water taken at a time when the water was being pumped directly from the lake, and, if possible, when the lake current was at the same time westward. He collected the samples on Oct. 3rd, as follows:

1. From Lake Erie near the end of the 10 inch intake pipe.
2. At the pump house at a time when water was being pumped both from the lake direct and from the Cook wells.
3. At the pump house when water was being pumped from the Cook wells alone.

The results of the examination of these samples were as follows:

CONNEAUT WATER, OCTOBER 3, 1899.

No. 743, from lake directly over the intake.

No. 744, from the pumping station through lake intake.

No. 745, from pumping station from Cook wells direct.

PARTS PER MILLION.

Number of sample.	743	744
Color .....	.10	.10
Turbidity	slight	slight
Sediment	very slight	slight
Odor	none	none
Oxygen required	2.11	1.98
Nitrogen as free ammonia .....	.002	.002
Nitrogen as albuminoid ammonia .....	.099	.102
Nitrogen as nitrates .....	.06	.04
Nitrogen as nitrites .....	.009	.008
Chlorine	4.8	5.2
Alkalinity	96.2	98.0
Incrusting constituents	4.2	none
Total solids	158.	164.
Volatile and combustible	61.	57.

The chemical findings in samples 743 and 744 are so nearly identical that the results furnished no evidence of any beneficial results from the Cook wells provided 744 is a mixture of the waters from the Cook wells and from the lake direct, while 743 represents lake water solely.

BACTERIOLOGICAL EXAMINATION.

	No. 743	No. 744	No. 745
Bacteria per c. c.	95	238	133

It will be noted that there was not a large number of bacteria in the lake water at the time this examination was made. Colon bacilli were found in the sample collected when pumping direct from the lake and also in the sample collected when pumping solely from the Cook wells.

In addition samples were collected from three private wells, not suspected of having caused the disease, but located in a thickly settled part of the village.

The evidence here presented shows that in all probability the public water supply of Conneaut was largely responsible for their epidemic of typhoid fever. It may be briefly summed up as follows:

1. Eighty-four, or 89 per cent. of the cases reported since the outbreak used hydrant water.
2. The west end of the village, where wells are used almost exclusively, escaped the disease.
3. Colon bacilli, indicating sewage contamination, were found in the hydrant water when water was being pumped from the lake.
4. The fact that the conditions are such that the lake water at the intake cannot escape pollution at times.
5. The coincidence in the time of the prevalence of typhoid fever, and of the time of the use of lake water.

In conclusion I wish to report that Senator Garfield called upon me recently on the part of the receiver, his law partner, to obtain information as to the best measures that could be taken to furnish Conneaut with an adequate supply of pure water. He emphatically stated that the bondholders were willing and ready to make such changes and improvements as would be required to this end. It is more than probable that the epidemic of typhoid fever in Conneaut will secure for the city an excellent supply of pure water. But what a pity that the lesson had to be learned by such a sad loss of life and health; for the conditions which have existed at Conneaut must inevitably have produced their evil results, as might easily have been foretold by any one versed in sanitary matters. But worse to consider is the fact that many other Ohio cities are in much the same condition; and though warning may not come by an epidemic outbreak forcing a cure of existing evils, nevertheless their citizens are paying dearly and annually by typhoid fever and other diseases, for their criminal carelessness, more often criminal penuriousness, in permitting such things to be.

Respectfully submitted,

C. O. PROBST,
Secretary.

October 18, 1899.

As a result of this inspection plans for filtering the water supply of Conneaut were presented to the State Board of Health and were duly approved. Further note is made of this in a report on "Filtration of the Public Water Supply of Conneaut," to be found under Public Water Supplies.

REPORT OF AN INVESTIGATION OF SMALLPOX AT
HIGGINSPORT.

To the State Board of Health:

GENTLEMEN:—I have the honor to present the following report of an inspection made by me at Higginsport, O., on the 2nd and 3rd of June, of a contagious disease now prevailing at that place, the character of which has been in dispute.

Higginsport is a place of about 900 inhabitants on the Ohio river about fifty miles above Cincinnati.

Early in March, Edgar Walton and ——— Gayton, deck hands on the steamboat Courier, went to their homes in Higginsport sick with an eruptive disease, the character of which was not suspected. From these cases others have developed and there have been differences of opinion as to the diagnosis of the affection. Gayton visited the family of his mother-in-law, Maria Smith, where there were seven children, two of whom had never been vaccinated and one unsuccessfully vaccinated in 1894. These three took the disease, all of those protected by vaccination escaping. From these cases others occurred until there have been about seventeen cases—thirteen colored and four white—with one death—or rather two deaths, one patient being prematurely delivered of a still-born child and dying the same day.

Of the eight cases that I saw, all presented unmistakable evidence of smallpox. The clinical history, the appearance of the eruption and the protective influence of vaccination are sufficient to make the diagnosis certain.

It is to be regretted that there is no board of health in Higginsport. A board was elected about a year ago, but all the persons selected refused to serve. There is, therefore, no board to enforce the necessary precautions in regard to isolation, quarantine, vaccination and disinfection. Not a house has been disinfected, persons in the eruptive stage of the disease go about the streets and visit families as they wish, children from infected houses went to school until the close of the school year, and the prospect is that while there is such a lack of public spirit that persons cannot be found to organize a board of health, the disease will spread until the material is exhausted. The Mayor, Thomas Dugan, and the village Marshal have done all in their power to check the disease, but from lack of support, general indifference to sanitary regulations and opposition engendered by differences of opinion as to the nature of the disease have rendered their efforts of little avail.

What is needed is the establishment of a board of health to enforce general vaccination, strict quarantine and disinfection. These measures I have urged upon the Mayor and the physicians of the village and I

would recommend that our Board, through its Secretary, endeavor to have them carried out, and that instructions in regard to disinfection and other preventive measures be sent to the local board when organized.

Respectfully submitted,

BYRON STANTON.

Cincinnati, O., June 3rd, 1899.

REPORT OF AN INVESTIGATION OF SUSPECTED DIPHTHERIA AT SOMERSET.

The following communication was received from citizens of Somerset, Ohio, asking the State Board of Health to make an investigation of some form of throat trouble, suspected to be diphtheria, prevailing at that place.

SOMERSET, OHIO, *October 25, 1898.*

DR. C. O. PROBST,

Secretary of Ohio State Board of Health,
Columbus, Ohio.

DEAR SIR:—We the undersigned citizens and heads of families of this city of Somerset, O., do hereby appeal to your Board to take such action as may be practicable to prevent the spread of infectious and contagious diseases in our village, against which our officials have been inert, negligent to such an extent as to afford us no practical protection, to prevent the spread of contagious diseases—diphtheria, membranous diphtheritic croup, etc. Cases, on what seem to us to be good authority, said to be of these diseases, deaths occurring, have gone without quarantine. An instance of recent date, the attending physician pronounced the case membranous croup. Child died, no quarantine. Several new cases of diphtheria have developed within the last ten days supposed to have originated from the neglect of the above cited case. We petition you to investigate the situation here. When we speak to our officials they say they have no authority to act. Our physicians do not act in harmony in the matter. Our recourse, as we understand it, is to you.

W. F. GORDON (and 65 others).

Dr. J. C. Crossland, member of the Board, was appointed to make an investigation and reported as follows:

To the State Board of Health:

GENTLEMEN:—I spent November 2nd in Somerset investigating the prevalent throat trouble and getting the local health board in working order. I got what I believe to be the true history of the origin of the disease in Somerset. About two months ago a family moved into the town from a rural community where throat disease had been prevalent. Two children in this family are said to have been suffering from catarrhal discharge from the nose and excoriations from the nose and face generally. They associated with a family of seven children across the road, one of which about a week after took sick and died of what is now alleged

by the physician to have been membranous croup. There was no quarantine and the health officer says no report of the case was made. The attending physician says his visits to the house ceased with the death of this child, but says he was consulted at his office about the other six children while they were one after another having throat disease. I talked with the mother who was not entirely convalescent from a mild infection. I secured reliable information that several other cases had occurred and convalesced except one child of two years, which died. In the latter instance the attending physician claims that he did not know the cause of death. Another child in this family undoubtedly had the disease, and the child which died certainly died of the prevailing disease. In both instances there was no quarantine, and public funerals. I secured information concerning several other cases not reported or quarantined, which were cases of the prevalent disease.

The board of health has not had a meeting for over one year and there were only four members of the board. The health officer has not been paid for the above period and council was disposed not to provide the board any funds. This, I believe, is substantially a true history up to within a day or two of my visit.

I visited one family where five children were sick in different stages of the disease and the grandmother was also slightly infected. These cases had been diagnosed diphtheria by the attending physician and reported and quarantined shortly before my visit to the town. There was no difficulty in confirming the diagnosis. I visited another family on the other side of town and found a case of scarlet fever which had been reported by the attending physician the evening prior to my visit and quarantined. This case had been thought to be diphtheria up until the appearance of the rash on the day of my visit. In the township nearby was another family suffering from either scarlet fever or diphtheria. So I was informed. Relying upon hearsay, there certainly have been other cases of scarlet fever in town. Another physician informed me that he had at that time one genuine case of diphtheria. So my investigation revealed the fact that there had been during the past six or eight weeks a large number of cases of throat disease which were without doubt diphtheria, chiefly, and scarlet fever.

I attended a called meeting of the health board which was attended by all the physicians practicing in the community and an agreement was made to report all cases and arrangements were made to quarantine all true and suspicious cases, and take all other proper and customary steps to suppress the disease. I advised closing the schools and prohibiting public meetings until the 14th inst., and the local board so ordered. Universal harmony now seems to prevail and I believe the disease will be suppressed.

Respectfully,

J. C. CROSSLAND.

PUBLIC WATER SUPPLIES.

REPORT UPON THE PROPOSED WATER SUPPLY FOR BEREA.

To the State Board of Health:

GENTLEMEN:—At the request of the authorities of Berea this Board acted upon a proposed water supply for that village, to be obtained from drilled wells; this source to be used for domestic purposes; and a second supply, to be obtained from springs in quarry beds, to be used for fire purposes only. An investigation was made by Dr. Miller, and on his recommendation the proposed supply was approved.

Later the consulting engineer, Mr. Chapin of Canton, stated that further pumping tests demonstrated that enough water could not be obtained from the wells for the purpose desired. He now comes before the Board with another proposition, asking for approval, which is embodied in the following communication:

CANTON, OHIO, *Sept. 17th., 1899.*

DR. C. O. PROBST,

Secretary State Board of Health,

Columbus, Ohio.

DEAR SIR:—Your kind favor of the 15th received, and on last night was reported to the Berea Water Board. And I am authorized to make the following statements to your Board:

First:—We are satisfied that we have exhausted the question of a supply from deep wells in the "old river trough," and cannot obtain supply.

Second:—We then must go to the rock supply or to the river.

Third:—From the many excavations made by excavating rock, and from drillings in the rock by the Stone Company in the last thirty years, we are satisfied that a potable supply cannot be had from rock wells. The water from these wells and from most of the quarry excavations contains large amounts of alum.

Fourth:—As to quantity, we can get an adequate supply from the quarry pit mentioned in former letters, and the source of this supply seems to come partly from the rock walls and bottom, and partly by infiltration from the river through the dirt and loose rock fills making the southeast side of this pit. As to quantity, we know that some five years ago this pit was pumped to determine the amount of water therefrom, and it took something like thirty days for the pit to refill. The capacity is so far unknown, but to the first ledge contains about 2,800,000 gallons, while an unknown area, having a depth of about 20 feet, exists below this first ledge.

Fifth:—The normal quality of this infiltration water, we think cannot be determined except by pumping down through a period of time sufficient to develop the normal water therefrom. The pit is used as a bathing place by the boys of

the town at present, and much vegetable matter has accumulated therein since last pumped out, which in our opinion accounts for the odor and organic matter shown by examination.

Sixth:— In the past year one-half of the business portion of the town has been destroyed by fire, and the only fire protection to be had is from the river as given by the Cleveland fire department when in need of same. And the water for such taken from the pools in the river.

Seventh:— All wells in the town are dry weather wells, and are not available in time of drouth for protection, while cisterns are rare owing to lack of rain in summer seasons.

Therefore the Board feels that they must give the town fire protection, and if the normal water of the quarry pit or river is susceptible to purification to fit it for domestic consumption, that they must put in such purification plant to enable them to furnish water for household purposes.

We therefore wish to know if in your opinion this water can be filtered so as to render it fit for domestic consumption.

We also ask permission to use this water for fire protection alone. We send you herewith eight copies of a blue print, showing the surroundings of the quarry pit under consideration, with location of proposed intake pipes and pumping station.

In the absence of complete data as to characteristics of the normal water from this pit we propose, if permission is granted by your Board, to construct a fire protection system, and after pumping and cleaning the pit thoroughly, continue such pumping for such time as will develop where the supply of the pit comes from and its normal condition. Then if such water is susceptible to purification to put in such a plant. From our present knowledge, if such water can be so purified, we propose to install a gravity filtration plant in the pump room of one 14-foot mechanical filter, using such chemical for coagulant as will give best results. We propose to take the raw water for such filter from the river above the railroad bridge at point marked "A" on plan, or if possible from adequate supply from the quarry pit, by damming off a portion of the same for a clear water well, into which the filtered water will be discharged and stored.

We hope that action on this application for use of such water for fire protection will be promptly taken by your Board, and that you will advise us of your opinion as to the question of possibilities for filtration of this water to fit it for domestic purposes without much delay.

Respectfully submitted,

BOARD OF WATER WORKS TRUSTEES OF BEREÄ, O.

By L. E. CHAFIN, *Consulting Engineer.*

Approved, D. T. GOULD, *President.*

I also send you a plan showing location of proposed supply.

Samples of the quarry water and of the river water were examined by Mr. Horton, who reports as follows:

SAMPLES RECEIVED FROM BEREÁ, AUGUST 19, 1899.

PARTS PER MILLION.

	River Sample.	Quarry Sample.
Number of sample.....	607	608
Color .....	.17	.13
Turbidity	very slight	very slight
Sediment	none	none
Odor	woody	old beer or wood alcohol
Oxygen required.....	22.82	26.81
Nitrogen as ammonia free.....	.023	.040
Nitrogen as ammonia albuminoid.....	.201	.202
Nitrogen as nitrates.....	none	.5
Nitrogen as nitrites.....	none	none
Chlorine	9.9	2.8
Alkalinity	97.8	51.0
Incrusting constituents.....	257.2	114.2
Total solids.....	*681.	†312.
Volatile and combustible.....	169.	118.

* 670 after filtration.

† 306 after filtration.

I see no reason why this supply might not be a satisfactory one provided it is properly filtered.

It will require some further examinations to determine whether the water could be satisfactorily purified by the use of mechanical filters with alum as a coagulant. You will note that the alkalinity of the river water, and especially of the quarry water, is quite low.

Mr. Chapin, at my suggestion, is making examinations of the turbidities of the river water. It might become a question whether the low alkalinity would permit of enough alum being added to the water to overcome maximum turbidities.

Please vote upon the following questions:

a. To approve the proposed supply, but for fire purposes, and require purification of the water whenever it shall be placed in use for domestic purposes.

b. To disapprove the proposed supply unless provision is made now to purify the water in a manner satisfactory to this Board.

Yours truly,

September 19, 1899.

C. O. PROBST,
Secretary.

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY,

COLUMBUS, September 25, 1899.

Mr. L. E. Chapin, Consulting Engineer for Berea, Canton, O.:

DEAR SIR:—The State Board of Health has considered your application made for the village of Berea, to approve plans for obtaining a public water supply for that village, the source of supply to be from Rocky river and from an abandoned stone quarry.

You are hereby notified that the Board has voted to approve of said water supply with the following provisions:

a. That the water shall not be used for domestic purposes from either source unless purified to the satisfaction of the State Board of Health.

b. That in case the village decides to make use of the water for fire and purposes other than domestic purposes, an ordinance shall be passed by the village council prohibiting the use of the water for domestic purposes.

c. That the completed plans for purification of the water shall be presented to the State Board of Health for approval whenever it shall be decided to use the water for domestic purposes.

Yours truly,

By order of the Board.

C. O. PROBST,
Secretary.

REPORT UPON A PROPOSED EXTENSION OF THE WATER SUPPLY OF COLUMBUS.

At a meeting of the State Board of Health which was held in the city of Columbus on June 6th, 1899, Mr. L. B. Kauffman, Director of Public Improvements, Mr. Ira H. Crum, Director of Law, and Mr. Julian Griggs, City Engineer, appeared before the Board in reference to proposed changes in the plans for improving the water supply of Columbus. The following communication was presented to the Board:

COLUMBUS, OHIO, June 6th, 1899.

To the Honorable Board of Health of the State of Ohio:

GENTLEMEN:—The City of Columbus herewith submits plans for a storage dam in the Scioto River, of the gravity type, to be located about midway between the Jones and Fishinger Dams, and having its spillway at the side of the dam, fifty-two feet above low water in the river, and asks your approval of the plans for its ultimate construction.

The City also asks you to approve the plans for the present construction of the foundation of such a dam with its overflow crest at a lower elevation, as may be found expedient or necessary from financial or other considerations.

Respectfully,

L. B. KAUFFMAN,
Director of Public Improvements.

The Board voted to approve of the proposed changes in the plans upon certain conditions, which are set forth in the following letter of approval:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,

COLUMBUS, OHIO, June 10, 1899.

Mr. L. B. Kauffman, Director of Public Improvements, Columbus, Ohio:

SIR:—The State Board of Health has considered your application for the approval of the plans for extending the water supply of the city

of Columbus by the constuction of a storage dam in the Scioto river, to be located about midway between the Jones and Fishinger dams, the ultimate height of the dam to be 52 feet, and the present construction of the foundation of such a dam with the overflow crest at some lower elevation.

You are hereby notified that, at a meeting of the State Board of Health held June 8th, 1899 said plans were approved subject to the following conditions:

a. That the ground to be flooded by water by the proposed dam shall be stripped of vegetation and upper layers of soil (earth).

b. That the water so stored shall not be used for a public water supply unless purified in a manner satisfactory to the State Board of Health.

c. That completed plans for purifying the stored water be submitted to the State Board of Health within a reasonable time.

Yours Truly,

C. O. PROBST,
Secretary.

By order of the Board.

FILTRATION OF PUBLIC WATER SUPPLY OF CONNEAUT.

A serious outbreak of typhoid fever at Conneaut led to an investigation by the State Board of Health, which showed that the disease had been caused, in all probability, by the pollution of the public water supply by sewage.

The Company presented plans to the Board for approval which provided for the installation of what is called "A Jewell, High Duty, Gravity Filter Plant." The plant was guaranteed to have an average daily capacity of one million gallons of filtered water, and there was a further guarantee of a bacterial reduction averaging ninety-seven per cent when the two filters are operating at the rate of a yearly average capacity of eight hundred thousand (800,000) gallons per day of twenty-four hours and when the number of bacteria in the raw or unfiltered water is in excess of seven thousand (7,000) per cubic centimetre, and that the number of bacteria in the filtered water shall average not more than two hundred (200) per cubic centimetre when the number of bacteria in the raw or unfiltered water is less than seven thousand (7,000) per cubic centimetre. It was further guaranteed that, when the two filters are operating at the rate of a yearly average capacity of eight hundred thousand (800,000) gallons per day of twenty-four hours, the filtered water will be bright and clear and practically free from suspended matter and color visible to the naked eye and well suited to domestic use.

The Board voted to approve the plans for purifying the public water supply of Conneaut and the following letter of approval was sent to the Receiver of the Company:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,

COLUMBUS, OHIO, November 23, 1899.

Mr. Frederick C. Howe, Receiver for the Conneaut Water Works and Supply Co., Cleveland, Ohio:

SIR:—The State Board of Health has received and considered your application for a change and improvement in the public water supply for the village of Conneaut, Ohio, by the introduction of a Jewell Gravity Filter plant, to consist of two filters constructed in the manner set forth in the proposal of the O. H. Jewell Filter Company under date of October 6th, 1899.

You are hereby notified that your application has been approved by the Board.

Yours Truly,

C. O. PROBST,
Secretary.

By order of the Board.

REPORT ON PROPOSED WATER SUPPLY FOR FIRE PURPOSES FOR CRIDERSVILLE.

To the State Board of Health:

GENTLEMEN: The enclosed plans for a water supply for fire purposes for the village of Cridersville, have been submitted. The village is in need of an additional water supply for fire purposes and as will be seen by the plans and the letter enclosed from Mr. Reichelderfer the supply is to be taken from a well which will be operated by a wind mill. After looking over the enclosed plans and also the location I recommend that the source of water supply for fire purposes be approved.

R. D. KAHLE,
Committee.

CRIDERSVILLE, OHIO, June 30, 1899.

To the Honorable State Board of Health:

GENTLEMEN:—The council of the village of Cridersville is contemplating of building a reservoir or pool, 75 feet wide by 125 feet long, water capacity inside of embankment, height of embankment will be 7 to 11 feet.

The purpose it is to be used for is a reserve water supply for our fire cisterns which are too small in case of a bad fire, and will not be used for drinking or

cooking purposes. We will drill a water well and erect a wind pump and keep fresh water running in all the time so that the water will not become foul or stagnated. We intend connecting cisterns to pool by a four inch pipe and also have hydrants on line to connect fire engines to.

Please take this matter up at once and report to us, as we wish to begin work at once to better protect our town against fire.

Yours truly,

JOHN REICHELDERFER,
Committee and Member of Council.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, July 15, 1899.

Mr. John Reichelderfer, Committee and Member of Council, Cridersville, Ohio:

DEAR SIR: The State Board of Health has considered your application for the approval of plans for an additional water supply for your village to be obtained from a reservoir and well located near your village, and to be used exclusively for fire purposes. You are hereby notified that your plans have been approved by the Board.

Yours Truly,

C. O. PROBST,
Secretary.

By order of the Board.

REPORT UPON A CHANGE IN WATER SUPPLY FOR THE CITIES OF UHRICHSVILLE AND DENNISON.

To the State Board of Health:

The health officer of Uhrichsville reported that the Dennison Water Company was failing to carry out its contract of providing the citizens with a supply of good, wholesome water, suitable for domestic purposes, and wished the Board to make an investigation of their water supply.

Uhrichsville is one of the points which is being examined in connection with the investigation of the Muskingum river, and one of the samples is taken from Stillwater creek at a point where the water is taken for water works purposes.

The Dennison Water Company appeared before this Board some time ago with plans for filtering their water supply. It was represented to the Board that the source of supply, Stillwater creek, did not contain any pollution of a character to be injurious to health, but the supply was objectionable on account of the large amount of mud carried in the water. Filters that were submitted to the Board for approval were designed to remove this mud. The filters were constructed and were operated for a short time, but were never satisfactory. The amount of

sediment contained in the water was so great that it was necessary to clean the filters several times a day, and as a result the water was but little improved and the filters have recently been abandoned. The filtering material has been removed and a kind of reservoir is thus provided which does not hold a large quantity of water. An attempt is being made to improve the supply by adding one and a fraction grains of alum to the river water and allowing it to stand for a short time in this reservoir. The supply, however, is still unsatisfactory. There is great complaint, so it is represented, by the citizens of Uhrichsville and also from those at Dennison, as to the quality of the water supply. The health officer of Uhrichsville states that on account of the poor quality of the water many wells, which had been abandoned on account of suspected pollution, are coming into use, and that but few people are willing to use the public water supply for drinking purposes. The examinations of the chemist show that the water supplied by the company, while not containing a high amount of organic matter is an unsatisfactory one, and is often highly turbid and at times has a musty odor.

REPORT OF CHEMICAL EXAMINATION OF SAMPLES OF WATER COLLECTED AT
UHRICHSVILLE, OHIO, MAY 6TH AND MAY 31ST, 1889.

PARTS PER MILLION.

	Above.	Below.	Above.	Below.
Number of sample.....	427	428	486	487
Color .....	.2	.22	.3	.3
Turbidity .....	.30	.30	1.50	1.46
Sediment	slight	slight	considerable	considerable
Odor	none	none	musty	musty
Oxygen required	2.51	3.17	22.85	26.56
N. as Am. free.....	.053	.086	.037	.049
N. as Am. albuminoid.....	.131	.166	.456	.530
N. as nitrates.....	.02	trace	.12	.91
N. as nitrites.....	.010	.009	.002	.002
Chlorine	1.2	2.3	7.2	7.4
Alkalinity	112.0	95.2	47.1	40.4
Incrusting constituents	0.	22.4	36.4	6.3
Total solids	271.	278.	735.	753.
Volatile and combustible.....	61.	64.	77.	99.

REPORT OF CHEMICAL EXAMINATION OF SAMPLES OF WATER COLLECTED AT
UHRICHSVILLE, OHIO, JUNE 29TH, 1899.

PARTS PER MILLION.

	Above.	Below.
Number of sample.....	539	538
Color .....	.25	.3
Turbidity .....	.81	.85
Sediment	considerable	considerable
Odor	faint musty	earthy
Oxygen required	9.13	12.32
N. as Ammonia free.....	.134	.150
N. as Ammonia albuminoid.....	.222	.346
Nitrogen as nitrates.....	.13	.17
Nitrogen as nitrites.....	.007	.007
Chlorine	3.8	6.6
Alkalinity	98.4	59.5
Incrusting constituents	14.0	26.6
Total solids	324.	332.
Volatile and combustible.....	70.	85.

REPORT OF CHEMICAL EXAMINATION OF SAMPLES OF WATER COLLECTED AT
UHRICHSVILLE, OHIO, JULY 20TH, 1899.

PARTS PER MILLION.

	Parker house tap.	Above.	Below.
Number of sample.....	578	579	577
Color .....	.2	.23	.23
Turbidity .....	.12	.97	.53
Sediment	slight	much	much
Odor	earthy and slightly vegetative	e. and veg.	e. and veg.
Oxygen required	3.84	7.13	5.62
N. as Ammonia free.....	.002	.080	.134
N. as Ammonia albuminoid.....	.153	.320	.222
Nitrogen as nitrates.....	.03	.05	.06
Nitrogen as nitrites.....	.003	.010	.006
Chlorine	1.6	1.4	2.5
Alkalinity	105.0	92.0	93.0
Incrusting constituents	32.8	5.2	55.8
Total solids	267.	386.	316.
Volatile and combustible.....	67.	86.	75.
Bacteria per c. c.....	267	612	1140*

*Overspreading growths.

Big Stillwater, above town, at water works, 427, 486, 539, 579.

Big Stillwater, below town, at Scott's coal bank, 428, 487, 538, 577.

Big Stillwater, as delivered from tap in kitchen at Parker House 578.

The Parker House sample yielded better results than any sample taken yet from the stream. In comparing samples 578 and 579 it should be remembered that a severe storm occurred four days preceding the time of sampling. As their reservoir holds a three day's supply, and as they had the filter at the water works full, using it either as a filter or a settling basin, it will be seen that not all of the water in the reservoir would have been influenced by the storm.

The river work thus far indicates that the water of the stream becomes impurer under storm influences. Under these circumstances sample 578 would show up some better than sample 579. However the marked improvement in sample 578 is attributable to no one feature alone but to several conditions.

Part of the reservoir water had probably been filtered, alum had been used, and by subsidence much organic matter and clay had been deposited. These factors together with the presence of some water in the reservoir uninfluenced by the storm, are accountable for the great improvement in sample 578 over 579. While 578 is not a first class sample on account of physical characters, oxygen requirement, albuminoid ammonia and hardness, yet it is a great improvement.

A comparison of the factors for hardness shows the use of alum.

E. G. HORTON, *Chemist.*

On August 10th the health officer of Uhrichsville called on me by appointment, and together we presented the matter to the Attorney-General. He advised that action should be taken, under Sections 1774, 1777 and 1778 of the Revised Statutes, which provide in brief that council may by resolution direct the city solicitor to begin action for the revocation of the charter of the Company, on the grounds that their contract with the corporation of Uhrichsville is not being fulfilled. The council was further advised to refuse to pay water rents to the Company until a satisfactory supply of water could be furnished.

On September 4th, 1899, the District Superintendent of the Denison Water Supply Company furnished plans and specifications for a filtration plant with a request that such plans should be approved by the State Board of Health.

The plans provided for what is called a "Jewell, high duty, gravity filter plant" to consist of three subsiding-tank gravity filters 15 feet in diameter by 16 feet in height; a guaranteed capacity of 1,200,000 gallons of filtered water per day of 24 hours. The source of supply was to remain the same as heretofore, namely, Big Stillwater creek.

A copy of an agreement on the part of the O. H. Jewell Filter Company was filed with the Board in which it was agreed by said Company that the filtered water should be bright and clear and practically free from suspended matter visible to the naked eye, and said Company further guaranteed a bacterial reduction averaging ninety-seven per cent when the number of bacteria in the raw or unfiltered water is in excess of seven thousand per cubic centimetre, and that the number of bacteria in the filtered water shall not average more than two hundred per cubic centimetre when the number of bacteria in the raw or unfiltered water is less than seven thousand per cubic centimetre.

The plans were approved under the conditions shown in the following communication:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, O., September 16, 1899.

Dennison Water Supply Co., Dennison, Ohio:

DEAR SIRs:—The State Board of Health has considered plans and specifications for purifying the water supply of Dennison and Uhrichsville, submitted by you for approval. The plans call for three Jewell filters with a joint capacity of 1,200,000 gallons per day.

Your pumping figures show an average daily consumption for the eight months ending August 31, 1899, of 1,796,000 gallons of water, using the figure for slip given by your representative—8.4 per cent. Allowing 13 per cent slip, which is doubtless too high, judging from the report of our engineer, and the average daily pumping during this time has been 1,668,544 gallons.

As the three proposed filters have, jointly, a daily capacity of 1,200,000 gallons, the Board is of the opinion that an additional filter should be installed.

Data should have been furnished showing the amount of alum that can be added to the raw water without appearing in the filtered water, and the amount of alum that will be required to remove excessive turbidities.

The Board has voted to approve the plans proposed for improving the water supply of Dennison and Uhrichsville provided —

a. That not less than four filters of the size shown in the specifications be installed at this time.

b. That a thirty days' trial of the filters shall show the bacterial efficiency stated in your proposal, and that the filtered water shall not show the presence of alum.

c. That the plant shall be continuously operated so as to furnish water satisfactorily purified, as determined by the State Board of Health.

Respectfully,

By order of the Board.

C. O. PROBST,
Secretary.

The Company guaranteed to install the four filters as required by the Board.

DISAPPROVAL OF PLANS FOR A PUBLIC WATER SUPPLY
FOR THE VILLAGE OF GLOUSTER.

The State Board of Health was called upon; in August, 1898, to make an examination of a well located within the limits of the village of Gloucester, which it was proposing to use as a source of public water supply. An examination of a sample of the well water showed it to be

not of good quality, and the surroundings of the well were also unfavorable, so that the village authorities were advised to look elsewhere for a supply. In the spring of 1899 the Board was requested to approve plans for obtaining a water supply from an abandoned coal mine. The Engineer was sent to Gloucester to make an investigation, and presented the following report:

REPORT OF THE ENGINEER.

Gloucester, Athens County, population 3,000, is situated in the valley of Sunday creek and on the hills adjoining. It is a mining town of rather recent growth and has as yet no public improvements of any kind. By far the principal industry is coal mining, there is also a small brick yard. There are two mines almost within the corporation and four others a mile or two from it.

The question of a public water supply has been agitated for some years with but poor success, finally in the spring of 1898, after great opposition, it was voted to issue bonds for \$12,000 with which to build a waterworks. The reason for this strong opposition is not apparent, as the private wells are very poor and the insurance rate very high. One thousand dollars of this money is now being spent on a covered reservoir of 128,000 gallons capacity which is being built on a hill back of town. About \$500 has been spent on three attempts to get well water for a public supply. One well was drilled in town near Sunday creek and two were drilled some distance northeast of Gloucester. The first well in town was 8 inches in diameter and 300 feet deep. A small amount of water was found in the shale and sandstone above the coal, a little more in the coal and much more below the coal, but this was salty and could not be used. The two other wells were only drilled to the coal and gave but little water. They were not put down farther on account of the salt water below the coal. The general geology of the valleys here is, soil, etc., 20 feet thick, shale, 10 feet, sandstone, 45 feet, coal, 10 feet, fire clay, 12 feet. This brings the coal about 75 feet below the surface.

The neighboring creeks are not available for a supply as they are now, on account of the pollution from very filthy surface drainage. The amount of money at the disposal of the town is not at all sufficient to introduce a supply of this kind as it would be necessary to impound a great deal of water to tide over the scant flow of the streams in summer.

It is now proposed to use water from mine No. 6, owned by Rend & Co., for a public supply. The city is to own its own reservoir, mains, etc., and pay the mine owners \$60.00 per month to pump the water to the reservoir.

This mine is situated just west of Gloucester, some of the workings probably extending under the town a short distance. No. 6 is a shaft mine, the coal being found 71 feet below the surface here and overlaid with sandstone and shale as above. At present the mine is not being worked from its own tipple and it is not known when it will start up

again. Some coal is being taken out of the north side of the mine from mine No. 2 which adjoins No. 6. The mine is in two sections, one north of the entrance and one south of it. The water is pumped by air lifts from the low places in the mine to a large pit or swale and repumped from here to the surface by steam pumps. At present the south section of the mine, including a small portion of the north, and the northern section are drained to separate pumps and the water pumped through separate pipe lines to the surface. The south section is not being worked at all now, but it contains a great deal of coal yet and will be worked in time. The northern part is being worked through another mine as mentioned above.

It is proposed to use the drainage water from the southern section and let the northern part go to waste. As the mine stands, the water from the southern part is comparatively free from pollution.

The northern part contains the mule stables, the drainage from which is direct to the swale. In addition to this, the men use the abandoned workings as privies. It is claimed that the water never gets up into the old rooms, but there is nothing to prevent the seepage water from them from draining to the sumps. This water enters the mine from the roof and sides, flows down the sides of the entries to the sumps and pumped from there to the surface. Any filth in the rooms is liable to follow the same course, being washed along by the water. The drainage from the stables alone is enough to condemn the north section. The water from the south section is at present receiving no fresh pollution, but if the mine were started up again, the water would be polluted even if it were pure now. Old mine workings if carefully cleaned out and shut up could furnish a good water, but these seem to be the only conditions under which they can. The entries are practically streets, suffering the same pollution as a street does, to a lesser degree of course, and street drainage is not a very desirable drinking water.

Much of the mine water probably comes from the infiltration of the water from the small branches of Sunday creek, which flow above the workings, and it would have to be determined if this water was purified before it reached the mine as the creeks are pretty badly polluted.

There are two pumps at work on the mine drainage, one on each section. They are small Furness pumps each having a 12-inch steam cylinder, 12-inch stroke and 8-inch water end. Running night and day, at the rate of about 36 strokes per minute, keeps the water at a constant level in the sumps. This gives about 125,000 gallons of water per day from each section of the mine and as only one section, the south one, could be used at all, this is the total amount of water available for a public supply. New pumps would be installed if the water were to be used.

Sample No. 1, is taken from the north side of the mine and Sample No. 2, from the south side. Both waters are soft and are excellent for a supply in that respect.

Respectfully submitted,

B. H. FLYNN, C. E.

May 3rd, 1899.

REPORT OF THE CHEMIST.

Following is a report of the chemical examination of the samples collected by the Engineer:

PARTS PER MILLION.

	North side of mine.	South side of mine.
Number of sample.....	406	407
Color .....	.4	.15
Turbidity	very slight	trace
Sediment	considerable	very slight
Odor	manure	woody
Oxygen required	3.03	2.14
N. as ammonia free.....	.196	.048
N. as ammonia albuminoid.....	.176	.102
Nitrogen as nitrates.....	.11	.09
Nitrogen as nitrites.....	.009	.006
Chlorine	62.4	109.3
Alkalinity	240.1	341.8
Incrusting constituents	none	none
Total solids	652.	796.
Volatile and combustible.....	115.	104.

Sample No. 406 is so badly polluted that it is unnecessary to discuss it.

Sample No. 407 is a water which may be used, although not free from impurities. The chlorine is very high but as the presence of salt is known in that locality the greater part of the chlorine is doubtless of mineral origin. The amount of organic matter present in the form of ammonia and nitrous acid may come, and probably does, from decay of the abandoned woodwork in the mine. The physical characters are not bad. There is some hardness as shown by the alkalinity, but no incrusting constituents are present thus yielding a desirable water for boilers. If the water receives sewage pollution, it is but slight and not a direct pollution.

E. G. HORTON,
Chemist.

The question of approving this, proposed supply was considered by the State Board of Health at a meeting held in Columbus, June 6th, 1899, and upon motion of Mr. Hartzell, it was voted to disapprove this proposed supply.

The following letter was sent to the Mayor of Gloucester:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, O., July 10th, 1899.

Mr. Hugh Gormley, Mayor, Glouster, Ohio:

DEAR SIR: The State Board of Health has considered the proposition of the village of Glouster, as submitted by you, to introduce a public water supply to be taken from a shaft mine situated immediately west of the village and known as Mine No. 6. The chemical examination of samples of water taken from the mine show the water to be impure; and the examination made by the engineer resulted in his condemning it as a proper source for a public water supply.

You are hereby notified that the Board has disapproved of the use of Mine No. 6 as a source of public water supply for your village.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

REPORT UPON AN ADDITIONAL WATER SUPPLY FOR
GREENVILLE.

To the State Board of Health:

GENTLEMEN: I have the honor to submit the following report of an investigation of the new wells drilled at Greenville to increase the water supply at that place. These wells are several hundred feet from Greenville creek, a tributary of Stillwater creek, which flows to the Miami river. The wells now in use are at least five hundred feet nearer to the creek, but that the water comes from the same stratum of gravel is shown by the influence on the water in the new wells of pumping from the old. Five 8 inch wells have been drilled and one more is to be put down. They vary in depth from 48 feet to 54 feet, and the strata pierced are all about as follows:

1. Surface soil about 8 feet.
 2. Gravel 2 to 3 feet.
 3. Blue clay 17 to 23 feet.
- Water bearing gravel 6 to 29 feet.

The lower stratum of gravel is deeper as it approaches what is supposed to be the old bed of the river.

At the time of my visit, October 25th, no pump was connected with the new wells and it was impossible to obtain samples of water for analysis, but it was agreed that when samples could be obtained they should be taken in the presence of the mayor of Greenville, and his cer-

tificate as to the source was to accompany the samples. This was done and the result of the analysis of this sample and also the result of an analysis of a sample from the original wells is given below:

CHEMICAL ANALYSIS OF SAMPLES OF WATER COLLECTED AT GREENVILLE.

No. 810, sample from well No. 13, collected October 25, 1899.

No. 362, from pumps at wells, collected March 20, 1899, given for comparison:

PARTS PER MILLION.

Number of sample.	810	362
Color .....	.05	.2 (unfiltered)
Turbidity	trace	decided
Sediment	slight	slight
Odor	none	chalky
Oxygen required .....	.78	.50
Nitrogen as Ammonia free.....	.254	.186
Nitrogen as Ammonia albuminoid.....	.014	.020
Nitrogen as nitrates.....	trace	.08
Nitrogen as nitrites.....	trace	none
Chlorine	2.0	2.4
Alkalinity ..	353.0	361.4
Incrusting constituents	none	none
Total solids.....	404.	474.
Volatile and combustible.....	78.	93.
Iron	1.8	

Sample No. 810, considered from the point of organic pollution is a very good water, as shown by the low findings for oxygen required, nitrites, nitrates, albuminoid ammonia and chlorine. The free ammonia nitrogen evidently comes from reduction of the nitrates and is not objectionable. The water is rather high in alkalinity but as it contains no incrusting constituents it would meet with probably but little if any objection on account of hardness.

The only causes of objection from the consumer are a slight turbidity and sediment, and the presence of some iron. These objections should be minor ones in face of the good quality of the water from the sanitary side. On the whole this sample is slightly better than the one in March and is of the same origin.

E. G. HORTON, *Chemist.*

A comparison shows that the water from the new wells is at least as good as that from the old. The greater turbidity of the water from the new wells will, I think, disappear with further pumping.

Believing the new source of supply to be good, I recommend the approval of the wells now put down. The one well yet to be drilled will undoubtedly furnish water from the same source and equally good.

Respectfully submitted,

BYRON STANTON,
Committee.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, November 20, 1899.

To the Board of Water Works Trustees, Greenville, Ohio:

DEAR SIRs: The State Board of Health has considered your application for the approval of an additional water supply for the village of Greenville, to be obtained from five or six additional wells located a few hundred feet from Greenville creek. You are hereby notified that said additional supply has been approved.

I enclose a copy of the chemist's analysis of water from well No. 13 and give, for comparison, an analysis of a sample of water taken from an old well.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board.

REPORT ON PROPOSED WATER SUPPLY FOR JACKSON.

To the State Board of Health:

GENTLEMEN:—The Jackson Water Company, of Jackson, Ohio, requested the State Board of Health to approve of certain plans, as prepared by Messrs. Kinney and Boyer, Engineers, for a public water supply for that village. The engineer of the Board, Mr. B. H. Flynn, was sent to Jackson to make an investigation and he presented the following report:

"A private company has put down three wells and failing to find water now proposes to obtain a supply from the abandoned workings of the old Huron mine. The company put down one well near McDowell's run and two near Salt creek below Buckeye creek. The strata through which the wells were drilled and their depths are as follows:

No. 1.	No. 2.	No. 3.
41 Clay and blue mud.	10 Loam.	28 Sandy loam & blue clay.
78 Blue sand & shale.	51 Blue mud.	
118 Conglom'ate sandstone.	78 Conglomerate and shale	
233 Fire clay and shale.		

Well No. 1 contained some water, but it was pumped dry in ten minutes and the water showed traces of salt. Wells No. 2 and No. 3, near Salt creek, contained no water.

Three wells have also been put down near Salt creek in search of gas and oil, these failed to show anything but salt water. The only hope for a ground water in this section is the conglomerate and as this has failed to show any, it is probably impossible to obtain a supply.

The mine from which the water is to be taken is situated in the southwest corner of Jackson's corporate limits and near McDowell's run. It was worked out in 1892 and abandoned in July, 1896. The new workings are to the west as the coal ran out to the east. The coal vein is very irregular in its dip, but the general trend is to the southwest.

The old workings are now full of water and are pumped only enough to prevent the water from flowing over the divide between the two mines as shown in the accompanying sketch plans. The drainage from the new mine can never enter the old one, until the new workings are abandoned and allowed to fill with water and then to a slight degree only.

The mines are pumped by two Dean pumps of 200,000 gallons capacity each. It requires the removal of 40,000 gallons per day to keep the new mine dry, and of 95,000 gallons to keep the water of the old mine from running over the divide. Probably more than this would be available from the old mine if the water were kept pumped down. A small amount of surface water now enters the old mine from the old shafts, but this can easily be shut off and should be. The mine water itself is a ground water. It enters between the shale and coal at the bottom of the workings. Very little enters through the roof on account of the impervious material above.

The water from the old mine receives no fresh pollution except the organic matter constantly coming from the decay of the mine timbers and railway ties.

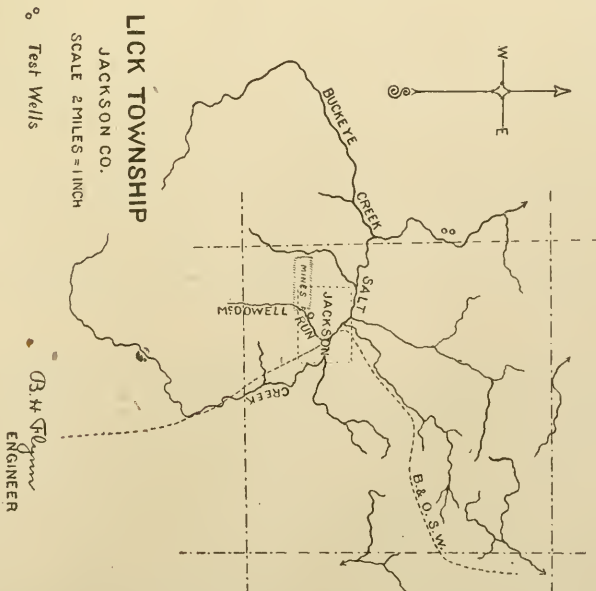
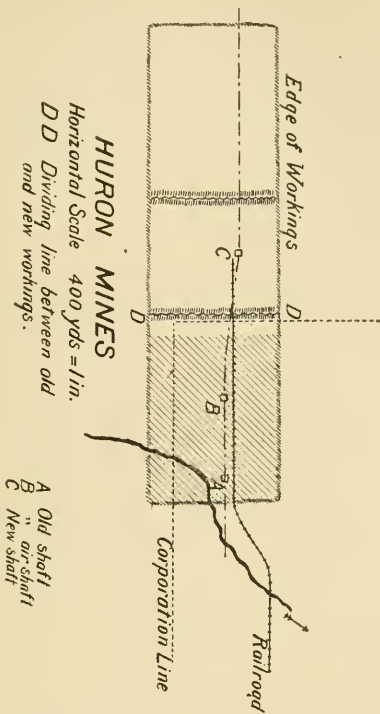
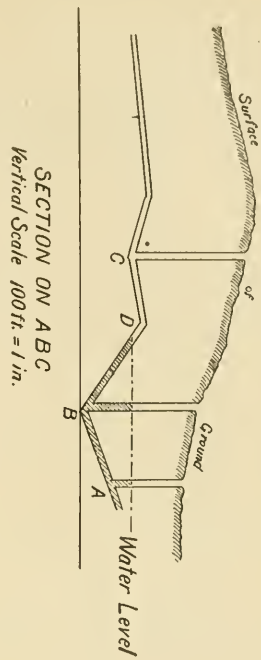
Sample No. 1 was taken from the new mine near where the men are working, and its high pollution shows the necessity of keeping out the drainage from that section. Sample No. 2 is from the old mine and shows high organic pollution, as expected, but the water may not be objectionable. Its quality could be improved by pumping out the mine and removing all the rubbish and the timbering not necessary to support the roof. If this were done and the connecting entries between the mines carefully closed up the water probably would not be objectionable.

The promoters have thought of supplementing the mine supply with water from McDowell's run, but this would require a separate investigation to determine its fitness. It is said that the run has a watershed of about five square miles and it seems to have but little pollution. The area is thinly settled. It might be advantageous to investigate impounding the water of this run for a supply; this would be a very expensive

source on account of the small watershed, necessitating a storage reservoir large enough to hold nearly all the flood flow. As far as noticed the other streams are not available for this purpose on account of the objectionable surface pollution from the dense population.

The private well supply of Jackson is very poor and a public supply is badly needed. The city has no sanitary sewers and vaults are not watertight and never cleaned out, new ones being dug when the old ones become filled. The wells are all dug and from ten to forty feet deep, getting their water in the clay and slate. The wells are filled entirely by surface water as can be seen from their condition after each rain."

The following illustration shows the location and a vertical section of the mine which it is proposed to use as a source of water supply; also the location of the test wells which were put down.



At a meeting of the Board held in Columbus, June 6th, 1899, Messrs. Kinney and Boyer, Engineers, appeared before the board and requested that the proposed plans for a water supply for Jackson be approved. The Board voted to defer action in the matter and to request the engineers to make further search for more desirable supply.

The following communication with reference to the inability of the Company to find a more suitable supply than the one proposed was sent to the Board:

State Board of Health, Columbus, Ohio:

GENTLEMEN:—At the last meeting of the State Board of Health the Jackson Water Company through its representatives appeared and having made report upon the efforts made to secure an underground water supply, sought permission of the Board to use an abandoned mine as a water supply for the city of Jackson, at the same time, it was frankly stated by the water company that they were still prosecuting a search for underground water. At this meeting it was finally decided by the Board to leave the question of the mine open until the water company had concluded the search for underground water and made further report to the Board. The water company having continued the search up to and including the 26th day of June and finding no usable water in appreciable quantities, and being firmly of the opinion that no such supply can be obtained, now desires to make the following report:

Since the commencement of the work five wells ranging in depth from 30 to 230 feet deep have been drilled, and 20 holes bored, in each case going to the rock. The first well along the McDowell run, was drilled to a depth of 233 feet through clay, shale and conglomerate. The well was tested with an air lift pump, and pumped dry in ten minutes. Our next well was located at the junction of Salt creek and Rock run about four miles from town, and drilled to a depth of 78 feet through clay, sandy loam, blue mud and conglomerate. This well was easily bailed dry in a few minutes. We now moved up Rock run hoping to find sand and gravel in the alluvial formation above the rock, the well was drilled through 30 feet of clay to rock and no water found. The record of the above three wells has been previously reported to the Board.

At this point we began to bore as well as drill. Starting close to the head waters of Salt creek about four miles from town and on the side opposite to where we had previously been working, we commenced boring and drilling in a northerly, southerly, easterly and westerly direction, putting down holes at intervals of about 2,000 feet. Two wells were drilled, one through 20 feet of alluvial formation and 38 feet rock, the other through 20 feet of clay and sandy loam to rock. When tested both these holes baled dry in less than one hour. Twenty holes were bored, in each case going to the rock. With these no better success was had than with the drilled wells.

In addition to the prospecting done by the water company, three deep wells ranging from 1800 to 2200 feet were previously drilled along Buckeye creek. Almost no usable water was discovered in any of these holes and none at all below 40 feet. The record of the deepest of these wells was obtained and placed in the hands of Mr. Flynn, the engineer of the Board. From our own experience, in drilling in the vicinity of Jackson, and from the data furnished by the three deep wells, it can be stated without fear of contradiction that underground water, to be used as a city supply, must of necessity come from the alluvial formation above the rock. Of the wells drilled by the water company, those going any distance into the rock soon began to show traces of salt. The deep wells showed no good water below the rock, as the record furnished Mr. Flynn will verify. It may be further stated that in earlier days salt boilings were extensively maintained in the vicinity of the city of Jackson. All the streams flowing through a shaly country, brought down and deposited nothing but mud or clay, almost entirely impervious to water. In fact the general geological conditions existing in and about the city of Jackson show a decided improbability of obtaining an underground water supply, and we believe the engineer of the Board so stated in his report. The work of boring and drilling was done under the direction of an expert and one who has made a thorough study of the geology of that section of the state. The question of impounding was given attention by a competent engineer who, after going over the ground thoroughly, reported such a plan not only impracticable but impossible.

The work herein described was commenced on the 18th of March, and prosecuted without interruption until the 26th day of June, and while entailing large expense upon the company our only regret is that no better success followed.

We desire to assure the State Board of Health that the water company has performed the work in the most earnest manner, using every means to insure success, fully realizing the prejudice that may exist in the minds of some at using the mine, no matter how good the supply might be. Finally, however, we were forced to conclude that further expenditure in prospecting for water would be useless and that the only possible supply is the abandoned mine, which it is herein proposed to make use of.

In conclusion it might be stated that one year ago a company of individuals had been granted a franchise, who after going over the grounds, looking for a supply and meeting with little hope of success, eventually gave up the franchise.

RECAPITULATION.

Number of wells drilled, five. Depth from 30 to 230 feet.

Number of holes bored, twenty. All to rock.

Number of deep wells, three. Depth from 1800 to 2200 feet.

Because of the fact that all of the wells drilled by the water company into the rock, soon showed traces of salt and the further fact that the deep wells produced no good water below 40 feet, at which point the rock was reached, showing as before stated that any supply would have to be obtained from above the rock, two of the wells drilled and all of the holes bored by the water company went no deeper than the rock.

In light of all these facts and because of the certain belief existing in the minds of the petitioners that if the city of Jackson is to have a water supply it must be obtained from the abandoned mine, the Jackson Water Company herewith respectfully renews its petition to the State Board of Health to be granted the privilege of using said mine for such city supply.

Respectfully submitted this 27th day of June, 1899.

THE JACKSON WATER COMPANY,

Per James Kinney Jr.

The Board then voted to approve the proposed supply, as will be seen by the following communication:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, July 15, 1899.

Mr. James Kinney, Jr., Bellaire, Ohio:

DEAR SIR: The State Board of Health has considered your application for the approval of a public water supply for the city of Jackson, Ohio, to be obtained from an abandoned coal mine in the southwest corner of Jackson's corporate limits, near McDowell's run. In consideration of the fact that it is shown to be impossible to obtain a satisfactory ground water supply by means of wells, and impracticable to find a surface supply by the impounding of streams or otherwise, the Board has voted to approve your plans for obtaining a supply from the abandoned mine, but upon the condition, before making use of the water, that the mine shall be pumped out, and that all rubbish, organic matter and all timbering, not necessary to support the roof, be removed from the mine, and that the entries between this mine and those connected with it, which are now being worked, shall be carefully closed. This approval shall be considered null and void until these conditions shall have been complied with.

I enclose for your information a copy of the chemist's report of his examination of a sample of water taken from the mine.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

At a meeting of the Board held in Cleveland August 16, 1899, a communication was presented from Dr. W. E. Williams, Chairman of the Water Works Committee of the council of Jackson. He protested against using the proposed water supply on the ground that it would be practically impossible to remove sources of pollution from the old mine, but principally upon the claim that since the Board's approval of said supply there had been found, within a reasonable distance of Jackson, another source of water supply which promised to be of much greater purity and to be adequate in quantity.

Upon the representation of Dr. Williams, it was voted to reconsider the vote by which the proposed water supply of Jackson to be obtained from what is known as the Huron coal mine was approved and the Secretary was instructed to investigate the claim that a much better supply could be obtained elsewhere.

The Secretary presented the following report of such investigation:

To the State Board of Health:

GENTLEMEN: On September 5th I visited Jackson and made an investigation of a well proposed as the source of a public water supply for that village. The well in question is located about five miles south of Jackson and is bored to a depth of 102 feet. The soil formation is as follows:

Sand and clay.....	8½ feet.
Clean sand	19½ feet.
Hardpan	3 feet.
Sandrock and shales.....	71 feet.

Very little water is found under the hardpan. The well is overflowing. It was pumped for seven days, night and day, at a rate of about 140,000 gallons per twenty-four hours.

There is evidence to show that this water bearing sand stratum is of a very considerable extent, and there are a number of overflowing wells in the neighborhood. The Company has leased water rights on about 300 acres of land and expects to acquire more territory. They propose to put down a sufficient number of these wells to furnish an adequate supply of water.

A sample was examined with the following results:

CHEMICAL ANALYSIS OF SAMPLE OF WATER COLLECTED AT JACKSON.

PARTS PER MILLION.

Number of sample, 678; overflowing well 5 miles south of city.

Color	trace
Turbidity	decided
Sediment	considerable
Odor	earthy
Oxygen required	1.51
Nitrogen as ammonia free.....	.230
Nitrogen as ammonia albuminoid.....	.054
Nitrogen as nitrates.....	trace
Nitrogen as nitrites.....	none
Chlorine	14.0
Alkalinity	197.4
Incrusting constituents	39.6
Total solids.....	388.
Volatile and combustible	94.
Iron	3.2

Mr. Horton's remarks upon the sample are as follows: "The water bears the marks of deep water of good quality. The free ammonia comes from reduction of nitrates and is not objectionable. In fact the water is in good condition as regards organic matter. Its mineral character is far more preferable than most of our rock waters with possibly an exception as to the iron it contains. The water is not hard for a rock water and therefore the total solids are comparatively low. The chlorine is probably of mineral origin and is consistent with the geological formation. I take the water to be from the carboniferous conglomerate and it is quite similar to the Massillon public supply, although not quite as pure as the latter water and contains more iron than the latter. The objectionable features are the iron, turbidity, and sediment. On filtering the water through paper it was clear and without sediment. Even sedimentation would do much for such a water. Aside from the characters last mentioned the present sample is so far superior to the former sample (No. 494) taken from a mine, that comparison is unnecessary."

I would respectfully recommend that the supply be approved.

Yours truly,

C. O. PROBST,

Secretary.

The question was then resubmitted to the Board, of approving a water supply for the village of Jackson to be obtained from wells located south of Jackson, and the Board voted to approve said supply, as shown in the following communication:

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY.

COLUMBUS, September 25, 1899.

The Jackson Water Company, Jackson, Ohio:

DEAR SIRS: The State Board of Health has considered your application for the approval of a public water supply for the village of Jack-

son, to be obtained by a series of driven wells located south of the village of Jackson, and you are hereby notified that the source of such water supply has been approved by the Board.

You have already been furnished with a copy of the chemical report upon a sample of the water taken from a test well.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board. _____

REPORT UPON A PROPOSED ADDITIONAL WATER SUPPLY FOR KENTON.

To the State Board of Health:

GENTLEMEN:—On September 1st I went to Kenton to inspect the source of a proposed additional water supply for that city. At present they obtain their supply from deep wells located within city limits. There is nothing to indicate that this supply is polluted, but from increasing consumption the city has had an insufficient supply for two years or more. A deep well was sunk two years ago in the Calhoun farm in the Taylor creek valley, about one and a half miles south of the court house. The water contained sulphur, too much, it was thought, for public use. Afterwards a well 20 feet deep and 9 feet in diameter was put down near the deep well just referred to. It was pumped at a rate of 600,000 gallons in 24 hours, and has continued to flow since it was put down. A sample of the water was collected and examined by the chemist, who reported as follows:

KENTON WATER. CHEMICAL. CALHOUN WELL, SAMPLE TAKEN SEPTEMBER 1, 1899.

PARTS PER MILLION.

Laboratory number.....	670
Color .....	.12
Turbidity .....	.09
Sediment	slight
Odor	peculiar
Oxygen required	1.95
Nitrogen as albuminoid ammonia.....	.068
Nitrogen as free ammonia.....	.256
Nitrogen as Nitrites.....	none
Nitrogen as Nitrates.....	none
Chlorine	1.9
Alkalinity	362.0
Incrusting constituents.....	86.6
Total solids	679.
Loss on ignition.....	164.

Had this been sent in as a sample from a deep source, I would pass it and simply speak of the hardness and physical characters as in that case the high free ammonia would result from the reduction of the nitrates. But if the water is a shallow ground water then the free ammonia is so high as to be suspicious, although on the other hand the chlorine is so low that one would suspect little if any sewage pollution. The water is rather hard and would not be as desirable

for steam purposes on that account. The turbidity was almost entirely removed by filtering through a paper.

I cannot help noticing the resemblance of this water to a deep water.

E. G. HORTON, *Chemist*.

This not being entirely satisfactory a second sample was taken on October 2nd. The results of the examination of this sample were as follows:

SECOND SAMPLE FROM CALHOUN WELL, KENTON.

PARTS PER MILLION.

Number of sample.	741
Color .....	.09
Turbidity .....	.08
Sediment	slight
Odor	faint, peculiar
Oxygen required .....	.92
Nitrogen as ammonia free .....	.162
Nitrogen as ammonia albuminoid .....	.034
Nitrogen as nitrates	trace
Nitrogen as nitrites	none
Chlorine	1.9
Alkalinity	370.8
Incrusting constituents	87.6
Total solids	681.
Volatile and combustible	154.

The results of the analysis of the second sample are given with the exception of the incrusting constituents, and the indications are that the last sample will not differ materially from the first in that respect. From the standpoint of organic matter the present sample is the purer as shown by the smaller amounts of nitrogen as albuminoid and free ammonia, and the oxygen requirement. The falling off in the oxygen required and the albuminoid ammonia would indicate less organic matter of vegetable nature such as might come from surface washings. The amount of oxygen required and albuminoid ammonia are passably low now, but could probably be still lowered by protection of the water from surface pollution.

Although the well itself is shallow, everything in the analysis indicates that the water is of deep origin and I believe it is such. In that case the free ammonia comes from the reduction of the nitrates, and is not objectionable.

Accordingly the results show the water to be a good one from a sanitary view. The water is somewhat hard and it is possible that some consumers might object more or less to using it for steam or laundry purposes, but harder waters are in use in many places.

The physical characters would probably receive but little criticism from the consumers, and furthermore it is quite possible that the slight turbidity and sediment might with use pass beyond the possibility of objection.

E. G. HORTON, *Chemist*.

I would respectfully recommend that the proposed source for additional water supply for Kenton be approved.

Yours truly,

C. O. PROBST,

Secretary.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, October 26th, 1899.

To the Water Works Trustees, Kenton, Ohio:

DEAR SIR:—The State Board of Health has considered your application for the approval of an additional source of water supply for the city of Kenton, to be obtained from a well located on the Calhoun farm, in Taylor creek valley one and one-half miles south of the court house, and you are hereby notified that said additional supply has been approved.

Yours very truly,

By order of the Board.

C. O. PROBST,
Secretary.

REPORT ON WATER SUPPLY AND SEWAGE PURIFICATION
WORKS AT THE BOYS' INDUSTRIAL SCHOOL
AT LANCASTER.

At a meeting of the State Board of Health held in Cincinnati April 20th, 1899, the following report, with plans for a water supply, sewerage, and sewage purification for the Boy's Industrial School at Lancaster, was presented by the Secretary:

COLUMBUS, OHIO, July 12th, 1898.

To the Honorable Ohio State Board of Health:

GENTLEMEN:—In accordance with the instructions of the Board of Trustees of the Boys' Industrial School at Lancaster, Ohio, I present herewith plans for the sewerage, sewage purification and water supply of the Institution, prepared by myself and adopted by the Board, who ask for the approval of the same by your honorable body.

WATER SUPPLY.

It is perhaps unnecessary to call your attention to the urgent necessity of providing this institution with a supply of pure and wholesome water, as your Secretary, Dr. Probst, after an examination of the present supply in September, 1897, condemned the same and urged upon the Board of Trustees that steps be taken at once to supply an adequate supply of pure water. The conditions which then prevailed and which will remain unchanged until the proposed system is installed, were described in my preliminary report to the Board of Trustees November 14th, 1897, as follows:

I find that your water supply is obtained from three sources ; a well 330 feet in depth, located on the hill, upon which the main buildings are situated, springs situated about a mile northwesterly from the buildings, and a small stream, which last furnishes the greater amount of water used. The supply obtainable is about as follows during the summer months :

Deep well water, 3,000 gallons per 24 hours.

Spring water, 20,000 gallons per 24 hours.

Creek water, 160,000 gallons per 24 hours.

The actual amount of water pumped and used at the institution at present is about 60,000 gallons per 24 hours, which is 37,000 gallons more than can be obtained from the deep well and spring combined. The quantity of creek water pumped and used will be represented therefore by these last figures. The creek water is badly polluted, as has been shown by the analysis of Prof. N. W. Lord, and to the use of this water may be attributed the recent epidemic of typhoid fever, with a record of fifty-two cases and two deaths. The use of this water for drinking has been wisely discontinued, and the temporary expedient of delivering deep well water in barrels to the several buildings, and cutting off all drinking taps from the main supply, has shown conclusively the cause of the epidemic by arresting its progress. To prevent the re-occurrence of the experience of the past summer, it will be necessary to provide at once, a supply of pure and wholesome water sufficient for all purposes. The institution is at present using less water per capita than any other state institution that I am acquainted with ; and the amount needed will steadily increase with the introduction and extension of necessary plumbing fixtures, as well as by reason of an increase in population.

The supply to be provided at present, in my judgment, should not be less than 100,000 gallons per 24 hours, and an increase to 150,000 gallons should be provided for in the location of the works with reference to the supply, and in the installation of machinery.

To obtain the needed amount of water, two alternatives are presented. Either to collect and purify the creek water by filtration, or to seek a supply of uncontaminated water by drilling wells. There are many objections to the former alternative. The whole supply is only slightly in excess of your future requirements and a protracted drouth in the future may cut down the supply below your daily needs. Then, too, through negligence or accident the filtration may be imperfect at times, resulting in a re-occurrence of the fever. No possible advantage can be secured by an attempt to make use of any existing machinery. The present pumping station is dilapidated and inadequate, and the machinery insufficient and unsuitable for the heavy duty required. From an examination of the locality and the surrounding country, and from information obtained from the gas well drillers, I am of the opinion that a plentiful supply of potable water can be obtained from deep wells

drilled on the grounds of the institution. I have selected two alternative locations in ravines where a supply will, in all probability, be obtained by drilling to a depth of from 300 to 350 feet. It may be objected that the present deep well, furnishing as it does, only 3,000 gallons per 24 hours, furnishes a strong argument against the possibility of obtaining a sufficient deep well supply. But the bottom of this well, 330 feet below the top of the hill, is at least 200 feet above the stratum it is proposed to penetrate.

I recommend that test wells be drilled as soon as possible, so that plans may be prepared and specifications drawn for a pumping station, and machinery adapted particularly for the location and required lift, which can only be estimated at present. In my judgment, an air-lift for pumping the wells by compressed air will be found the best arrangement using a duplex air compressor. The water to be pumped from the wells into a storage reservoir of about 100,000 gallons capacity, from whence it will be forced into the mains and standpipe by suitable plunger pumps. The whole plant to be arranged in duplicate, so that an accident occurring to the machinery, will not deprive the institution of a water supply, as a stoppage of the pump, should a fire break out, would probably result in a loss far greater than the whole cost of the water works. In this connection, I desire to call your attention to the size of your present mains. The present force main, from the pump to standpipe, is 6 inches in diameter and the distribution system from the standpipe is of 4-inch and 3-inch pipe. These sizes are too small to furnish effective fire protection, and should be replaced with larger pipe before a serious conflagration brings the matter forcibly to your notice."

In accordance with my recommendations, the Board of Trustees caused three test wells to be drilled on the grounds of the Institution at the location shown on general plan of water works system.

The record for the first well, which is identical with the other two drilled except as regards depth of drift owing to difference in surface elevation, is as follows:

Drift	18 feet.
Sand stone (water bearing).....	42 feet.
Blue shale	50 feet.
Sand stone and shale in alternate layers.....	80 feet.
Sand stone (not water bearing).....	143 feet.
Sand stone (water bearing).....	50 feet.
Total depth	383 feet.

Water was found at a depth of 55 feet which rose and flowed over the top of the drive pipe at the rate of about 5 gallons per minute. As this water-bearing stratum was plainly the one now furnishing the deep well water to the Institution and could not be depended upon to furnish a sufficient permanent supply, I directed the drillers to case off this water and continue drilling. The well was cased with 5½ inch galvanized iron

casing to a depth of 192 feet and the drilling continued to a total depth of 383 feet, the last 50 feet of sand stone being the stratum in which the water was found. The water rose and stood in the well at a depth of 140 feet from the surface.

A pumping test was made by pumping for ten hours with a deep well pump at the depths of 170 and 210 feet from the surface of the ground. The capacity of the well when pumped at a depth of 210 feet was found to be 40 gallons per minute. The wells are placed about 100 feet apart on line.

It is proposed to drill three additional wells and equip all 6 wells with deep well pumps capable of delivering 50 gallons of water per minute each. The working barrels of the pumps to be placed 300 feet below the surface. The water from these wells is to be delivered into an underground reservoir of 100,000 gallons capacity, constructed of brick masonry laid in cement mortar and covered by brick arches supported by eye beams. From this reservoir the water will be lifted and delivered into the mains and standpipe the base of which is about 175 feet above the pump room floor. The plans for the reservoir, well houses and pumping station, which are well designed and highly attractive in appearance, as furnished by Richards and McCarty, architects, of Columbus. The plan presented for the water supply includes an entirely new system of force and distribution mains of ample size.

SEWERAGE AND SEWAGE PURIFICATION.

The present sewerage of the Institution is of a rather primitive character. The sewerage of the various buildings together with roof and storm water, is discharged at a number of points in ravines at the rear of the buildings. It is the sewage from the Institution itself that causes the greater part of the pollution of the present water system. It is proposed to retain the present sewers for the removal of roof and storm water only, and to construct a new system of pipe sewers for the removal of sewage proper. The system is arranged as shown on plan consisting of 6, 8, 9, and 10 inch vitrified, salt glazed pipe sewers, to be laid on a true grade with the joints well cemented and provided with manholes at each change of grade or direction. The manholes to be provided with locked ventilating covers. There will be three automatic flush tanks, located as shown on plan at the head of laterals. The minimum grade of sewers will be 4-10 of one foot per 100 feet.

The topography of the grounds is such that upon my first examination I was unable to find a suitable location for a system of sewage disposal other than a system of chemical precipitation owing to the extremely irregular character of the surface, which seemed to preclude a system of land disposal without excessive grading. Accordingly in my preliminary report I recommend the construction of a chemical precipitation system to be supplemented by coke filters. A more ex-

tended investigation, however, revealed the existence of a suitable location for a system of intermittent filtration in the bottom of a broad ravine and plans were prepared and are herewith presented for a system of this character. It is well that this was found possibly, as the Legislature in making the appropriation cut down the amount below the estimate so much that it would have been impossible to construct the work formerly proposed. The plan proposed contemplates the construction of 7 filters of a combined area of two acres. The filters are to be constructed of sand to be obtained by crushing sand stone from near by. This sand is of the same character and size as that used in the sewage filters for the Ohio State Reformatory at Mansfield, which have given such excellent results.

The beds are to be underdrained by parallel lines of 4 inch drains laid 10 feet apart, discharging into a main drain 24 inches in diameter, which is also intended to carry storm water from the ravine above the filters. My opinion is that with sand of the size it is proposed to use, good results can be achieved with a less depth of material than is commonly used for the coarser grained sand and gravel.

I have accordingly fixed the depth of sand on these filters at 3 feet 6 inches, believing that with that depth all requirements will be satisfied, and that with any greater depth the sand would drain so slowly during periods of rest as to interfere with perfect aeration. Should the results not demonstrate the truth of this assumption, the grades will admit of the addition of more sand. It is not proposed to attempt the separation of sludge beyond the removal of paper and other objects too large to pass a screen having openings $\frac{3}{4}$ of an inch between bars. The distribution will be effected by conveying this sewage from gate chambers in gutters formed of channel or half pipe laid along the upper side of each bed, the sewage to be discharged through notches in the side of the gutters placed every two feet.

The nearest building to the filters is the Administration building, which is 1280 feet distant and 157 feet above the nearest filter. The filters are located below the water works in the same ravine and distant 600 feet. The effluent from the filters will be discharged into a small stream bed by springs which finally discharge into the Hocking river.

Respectfully submitted,

JOHN P. FORCE,
Consulting Engineer.

COLUMBUS, OHIO, April 17th, 1899.

To the Honorable Ohio State Board of Health:

GENTLEMEN:—On July 12th, 1898, I presented plans for sewerage, sewage purification, and water supply for the State Boys' Industrial School at Lancaster, O.,—and asked for the approval of the same by your Honorable Body.—Shortly after the plans were filed with your Sec-

retary I found that on account of the location and construction of an electric railroad on the grounds of the Institution, subsequent to the making of my plans, the plan for the purification of the sewage would require alterations, as the railroad was constructed directly on the location selected for the filters. I accordingly requested your Secretary, Dr. Probst, to withhold the plans until alterations and amendments could be made consistent with the new conditions. I now present an amended plan of the filters. The change from the first plan presented consists principally in the subdivision of the filtering area into twenty-five separate beds containing the same total area of two acres as the first plan proposed. The grade of the bottom of the ravine, and consequently the railroad, being two feet in one hundred feet. I have made width of each filter fifty feet, thus placing them in terraces so that there is a difference in elevation of one foot between each filter and the next one adjoining.

The gate chambers are so arranged that two filter beds may be flooded at the same time.

The system of drainage, filtering material, and screen chamber proposed are identical with the description furnished in the first report. I respectfully ask your Honorable Body to approve the plan first proposed together with the change in sub-division of filters herein described and illustrated more fully by the accompanying plan.

Respectfully yours,

JOHN P. FORCE,
Consulting Engineer.

A sample of water from one of the wells proposed for the supply was collected on July 11th, 1898 and a second sample on December 24th, 1898. The results of the analyses are shown in the report of the chemist, as follows:

CHEMICAL EXAMINATION OF A SAMPLE OF WATER TAKEN FROM DEEP WELL No. 2,
BOYS' INDUSTRIAL SCHOOL, LANCASTER, JULY 11, 1898.

PARTS PER MILLION.

Color	2.2
Turbidity	distinct
Sediment	cons. earthy
Odor	none
Nitrogen as ammonia free.....	.0098
Nitrogen as ammonia albuminoid.....	.1608
Nitrogen as nitrates.....	.3111
Nitrogen as nitrites.....	.01
Chlorine	4.5
Oxygen required	3.772
Temporary hardness	37.0
Permanent hardness	16.84
Total solids	417.0
Loss by ignition.....	53.0

The low free ammonia, nitrites, and chlorine do not admit of sewage contamination. The oxygen required is higher than would be expected in a deep well and with the high albuminoid ammonia would indicate organic matter of vegetable origin. The physical appearance of the water is objectionable owing to the presence of dirt. If the well were to be pumped out and a sample taken in such a way as to prevent the accidental introduction of dirt and vegetable matter, the water would doubtless be very satisfactory.

E. G. HORTON, *Chemist*.

CHEMICAL EXAMINATION OF A SAMPLE OF WATER TAKEN FROM ONE OF THE DEEP WELLS, BOYS' INDUSTRIAL SCHOOL, LANCASTER, DECEMBER 22, 1898.

The well had been pumped continuously for three hours.

PARTS PER MILLION.

Color .....	.15
Turbidity	slight
Sediment	slight
Odor	slight earthy
Oxygen required	1.74
Nitrogen as free ammonia.....	.012
Nitrogen as albuminoid ammonia.....	.022
Nitrogen as nitrites.....	none
Nitrogen as nitrates.....	.068
Chlorine	3.5
Alkalinity	14.5
Incrusting constituents	3.2
Total solids	120.
Loss on ignition	7.0

This is a very satisfactory water. Probably the physical characteristics will improve as soon as the well has been used a short time.

E. G. HORTON, *Chemist*.

The Board voted to approve the plans presented, as above, and the following communication was sent to the Board of Trustees:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, May 1, 1899.

Mr. C. D. Hillis, *Secretary Board of Trustees, Boys' Industrial School, Lancaster, Ohio,*

DEAR SIR:—The State Board of Health has considered plans for a new water supply and for sewage disposal for the Boys' Industrial School, as prepared by Mr. John P. Force, Consulting Engineer, and you are hereby notified that said plans have been approved.

I enclose, herewith, for your information, a copy of the analysis of the proposed water supply.

Yours truly,

By order of the Board.

C. O. PROBST,
Secretary.

REPORT UPON THE PROPOSED WATER SUPPLY OF NEW RICHMOND.

To the State Board of Health:

GENTLEMEN:—I would respectfully submit the following report upon the proposed water supply of New Richmond, a town of about 2,500 inhabitants, in Clermont county, twenty-four miles above Cincinnati and about thirty miles below Ripley, the nearest sewered town above New Richmond.

It is proposed to erect water works in connection with an electric light plant. The water will be taken from the Ohio river at a point above the town and pumped to a reservoir on the hill. The capacity of the reservoir will be 750,000 gallons, the elevation above low water stage will be about 235 feet and the distance from the river about 2300 feet. The daily consumption, it is estimated, will be about 70,000 gallons but may go to 100,000 in a few years.

No purification is proposed except what can be secured by sedimentation. As the daily consumption will be but about one-tenth of the storage capacity, this will allow considerable time for purification by this means.

The pumping capacity will be 720,000 gallons in twenty-four hours. This will render pumping unnecessary when the electric lights are in use and will permit the pumping of several days' supply in one day, so that the water may be, much of the time, in that state of quiescence necessary for perfect sedimentation.

Sufficient ground has been purchased for another reservoir of the same capacity, should a second be rendered necessary by reason of increased demand for water. The intake will be on the Ohio shore and extend into the river as near as is permissible to the channel, with provision for taking the water from the most desirable depth of the stream.

The present supply is from dug wells which are about 60 to 65 feet deep, from driven wells from 60 to 90 feet deep and from cisterns filled from roofs. The wells yield a very hard water, limited in amount and objectionable for either domestic or manufacturing purposes. The principal objects of constructing water works are to supply water for fire purposes and a soft water for domestic and manufacturing uses.

As ample provision can be made for storing water a sufficiently long time to permit of considerable degree of purification by sedimentation, I would recommend the approval of the proposed source of supply.

Very Respectfully,

November 10th, 1898.

BYRON STANTON.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,

COLUMBUS, November 18, 1898.

Mr. Lou F. White, Secretary Water Works Trustees, New Richmond, Ohio,

DEAR SIR:—The State Board of Health has considered your application for approval of a public water supply for the village of New Richmond, to be obtained from the Ohio river, on the Ohio shore, at a point above the village, and the water to be pumped to a reservoir on an adjacent hill.

You are hereby notified that your plans have been approved.

Yours truly,

By order of the Board.

C. O. PROBST,
Secretary.

REPORT UPON AN INVESTIGATION OF THE PUBLIC
WATER SUPPLY OF NORWALK.*To the State Board of Health:*

GENTLEMEN:—A request was received from the mayor of Norwalk to make an investigation of their public water supply to determine, if possible, the cause of the development of bad odors in the water which was giving rise to much complaint among the users.

Norwalk introduced a new water supply, which was first made use of in the spring of 1898. The supply is obtained by impounding the waters of Norwalk creek. Two reservoirs were provided, an upper basin, with a capacity of about 118,000,000 gallons, which was to be used for sedimentation, and a lower basin, with a capacity of 190,000,000 gallons. Along in June or the first of July, 1898, the water developed a bad odor, which lasted, however, but a few days. The water at that time was being taken direct from the upper reservoir. The soil covered by this upper reservoir was not entirely removed in its construction and it contains a considerable quantity of vegetable matter. During the present year a similar accident occurred. There is some conflict in the statements as to the exact date of this development of bad odors, and the fixing of this time will have an important bearing on arriving at the cause of the trouble.

I visited Norwalk July 12th, accompanied by Mr. Horton, and an inspection of the reservoirs was made and samples of water collected for examination. We were assisted in this by members of the water works trustees. According to the report of the engineer, water was being pumped from June 9th to July 12th as follows:

June 9th to 11th from the upper reservoir, or from the old pumping station.

June 12th to 21st from the lower reservoir.

June 22nd to 25th, or possibly 26th, from the old pumping station.

June 25th, or possibly 26th to 27th, from the upper reservoir by gravity.

June 28th to time of our visit, July 12th, from the lower reservoir.

The pumping station spoken of was the source of water supply for the city prior to the introduction of the new supply. The pumping machinery is still in place and was used as stated.

Water at the old works is taken directly from the Huron river. There is a discrepancy, as stated, as to the exact time when bad odors developed in the water. The engineer stated to us that it was on June 26th and 27th. One of the water works trustees, who was with us, stated that he was positive that the waters smelled badly on June 25th, it being so disagreeable that he could not bathe in it on that day. Mr. E. A. Smith, secretary and superintendent of the water works company, stated that he was very positive that the bad odors were noticed first on July 2nd, and that this had entirely passed away by July 4th. He says no complaints were made to him, or to the company, in regard to bad odors during the week before. Considering the fact that water was being taken from three different sources at various times not long preceding this trouble, the importance of having the dates exactly fixed will be apparent. I have not been able, however, to straighten out this conflict in statements.

Two samples were taken from the lower reservoir, one at about 15 feet and the other 31 feet. It may be said here that the ground covered by the water in this reservoir was entirely stripped and it contains little vegetable matter. A sample was taken from the upper reservoir and another sample from a tap in the yard of Mr. Smith, the superintendent. Mr. Smith is on a "dead end" and there are no other users of water from this part of the pipe.

Mr. Horton submitted the following report:

CHEMICAL EXAMINATION OF SAMPLES OF WATER FROM NORWALK.

PARTS PER MILLION.

	Lower Reservoir, depth 15 feet.	Lower Reservoir, depth 31 feet.	Upper Reservoir, via underdrain.	Outside tap, E. A. Smith's house.
Number of sample.....	552	553	554	555
Color .....	.23	.23	.35	.30
Turbidity	very slight	very slight	very slight	very slight
Sediment	very slight	very slight	slight	slight

CHEMICAL EXAMINATION OF SAMPLES OF WATER FROM NORWALK. — Concluded.

	Lower Reservoir, depth 15 feet.	Lower Reservoir, depth 31 feet.	Upper Reservoir, via underdrain.	Outside tap, E. A. Smith's house.
Odor	vegetative	vegetative	like hydrogen sulphide when first taken	like hydrogen sulphide when first taken
Oxygen required	7.35	6.00	12.78	7.76
Nitrogen as Ammonia free.....	.254	.220	.388	.348
Nitrogen as Ammon. Albumin d.....	.178	.190	.420	.154
Nitrogen as nitrates.....	.04	.04	trace	trace
Nitrogen as nitrites.....	.040	.044	.004	.001
Chlorine .....	.9	.9	.6	.7
Alkalinity	78.0	78.4	82.6	83.0
Incrusting constituents	4.4	4.0	none	none
Total solids	169.	184.	213.	167.
Volatile and combustible.....	60.	77.	81.	62.
Bacteria per c. c.....	375.	463.	1032.	not taken

Chemically the waters are fairly good. The very low chlorine indicates the absence of sewage pollution. There is much vegetation in the water as shown by the oxygen requirement and the nitrogen determinations. The biological examination revealed many low forms of plant and animal life, the most of them being harmless. The organisms found which have been known to cause troublesome tastes and odors in water were *asterionella* and *synedra*, but these were not present in sufficient numbers to cause a noticeable odor. In fact samples 552 and 553 developed no odor that could be called objectionable between the time of sampling and the present date. While 554 and 555 had odors like hydrogen sulphide at the time of collection, they smell of vegetation now.

The diatoms named above were found almost entirely in 554 and 555, being very scarce in the two samples from the lower reservoir. In 554 and 555 were found one or two forms of *crenothrix*.

There was more or less doubt as to the exact date of the odor but assuming the later date to be the correct one it was then ten days from the time water smelled until our samples were taken, and during that period no trouble was experienced from the same cause. As would be expected under the circumstances it would be difficult to determine the cause after such a lapse of time with no recurrence of the trouble.

There was nothing found in samples 552 and 553 to indicate that trouble might have come from the lower reservoir. The results of the analyses show that 555 is quite similar to 554. Again Mr. Smith maintained that the water from the tap near the dead end was some of the objectionable water. This would indicate that the objectionable water came from the upper reservoir.

In conclusion, I cannot say what the cause of the odor was, but notwithstanding the date given by Mr. Smith as that when the odor was present, I am inclined to think the trouble came from the upper reservoir and may have been due to diatoms of the forms *asterionella* and *synedra*.

Should the trouble manifest itself again it should be reported at once and investigated promptly.

E. G. HORTON, *Chemist*.

It will be noted that Mr. Horton calls attention to the great similarity between the sample of water from the upper reservoir and the one taken from the "dead end" of the main, at the house of Mr. Smith, which seems to indicate that the water which was the cause of the trouble came from the upper reservoir. In collecting this sample from the upper reservoir it was done by opening valves and permitting the reservoir to discharge from an under-drain which passes under the lower reservoir. There was a most decided odor from the water that came from this upper reservoir, and all of the gentlemen present testified that it was of the same character as that which had developed in the water supplied by the mains, and about which complaint had been made. While the evidence is not entirely clear, it would point to the conclusion that the bad odors were due to water taken directly from the upper reservoir, charged with the products of decaying vegetable matter, possibly algæ. The subject is one of interest, as Ohio waters have been comparatively free from this source of trouble, which is a matter of frequent complaint in the reservoir waters of some of the eastern states.

Respectfully submitted,

C. O. PROBST,

Secretary.

August, 1899.

REPORT ON PROPOSED WATER SUPPLY FOR POMEROY.

To the State Board of Health:

GENTLEMEN:—Pomeroy, the county seat of Meigs county, situated on the Ohio river, is a city of about 5,600 inhabitants. A water company, with incorporators residing at Scranton, Pa., secured a franchise for furnishing water to the city. It is contemplated that the village of Middleport, immediately adjacent to Pomeroy, may some time be supplied with water by the same plant.

The laying of mains and some other preliminary work was begun some weeks ago, and, through ignorance of the law, the plans were not referred to the State Board of Health for approval. Having called the attention of the mayor to the matter, I was requested to come there and make an investigation, which I did on December 13th.

Water is to be obtained from the Ohio river by an intake extending 30 feet from low water shore line, and to be 5 feet under water at the low water stage. The intake located about 800 feet above the present mouth of Kerr's run, and just above the Coalridge Salt Company's plant. The water will be pumped first to a stand pipe of 230,000 gallons capacity, located on a hill near the pump house. The works are planned to supply five thousand people with fifty gallons per capita. - All the water is to be metered, and it is believed that the amount used will be less than this. The standpipe will provide for a little less than 24 hours sedimentation. Water will be drawn from the standpipe and passed through a Wetheril

mechanical filter, estimated to have a capacity of 500,000 gallons for twenty-four hours. The total area of the filter is 187 square feet. Valves are so arranged that it is impossible to pump water to the mains without first passing it through the filter. The filter, however, may be used direct without first pumping the water to the standpipe.

Arrangements are made for cleaning the filter by backward flow of filtered water. The plans do not contemplate the use of any coagulant in connection with the filter. Surplus water will be delivered to a reservoir located on Lincoln hill, and 302 feet above low water mark. The reservoir has a capacity of 261,000 gallons, being 60 feet in diameter, and allowing a depth of water of 13 feet. It is to be constructed of brick with a concrete bottom and earth embankments with retaining walls. The company is to lay $5\frac{1}{2}$ miles of main pipe and to furnish the city with thirty-five fire plugs and four public fountains.

The nearest town contributing sewage in any amount to the Ohio river above Pomeroy is Marietta, which is about 75 miles from Pomeroy.

The plans seem calculated to furnish reasonably pure water though in my judgment it may be found necessary to provide for a longer period of sedimentation than is contemplated at present.

I would therefore respectfully recommend that the plan for a public water supply for the city of Pomeroy be approved.

C. O. PROBST,
Secretary.

December 19, 1898.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, December 27, 1898.

Mr. A. H. Seebohm, Mayor, Pomeroy, Ohio.

DEAR SIR: The State Board of Health has considered the application of the waterworks company for approval of a public water supply to be furnished to the city of Pomeroy, and to be obtained from the Ohio river at a point about 800 feet above the present mouth of Kerr's run and 30 feet from low water shore line; the water to be filtered in a satisfactory manner by passing it through a Wetheril filter. You are hereby notified that the plans and source of said proposed water supply have been approved.

Yours truly,
C. O. PROBST,
Secretary.

By order of the Board.

REPORT UPON A PROPOSED CHANGE IN WATER SUPPLY OF SHREVE.

To the State Board of Health:

GENTLEMEN: I visited Shreve at the request of the State Board of Health. It is a village of about 1400 inhabitants, and has had a public water supply upwards of ten years. The authorities wish to make a change of source for several reasons. First, because the present source is located too near the stock yards; also because in times of greatest needs the supply is inadequate.

The change is also made easily desirable by the fact that about a mile from the village there is a spring of excellent reputation and considered to be adequate in respect to quantity. The surroundings of this spring are entirely irreproachable, there being no habitations near, or any apparent sources of pollution. The water collected below this spring has been used for many years as an ice supply. The chemical examination of this water by Mr. Horton, Chemist of the State Board of Health, resulted as follows:

PARTS PER MILLION.

Number of sample.	548
Color .....	.13
Turbidity	distinct
Sediment	very slight
Odor	none
Oxygen required	1.56
Nitrogen as free ammonia .....	.006
Nitrogen as albuminoid ammonia .....	.024
Nitrogen as nitrates	2.01
Nitrogen as nitrites	none
Chlorine	3.5
Alkalinity	169.2
Incrusting constituents	8.0
Total solids	308.
Volatile and combustible	118.

The nitrates and chlorine on the one hand and the turbidity on the other hand are the only features to be noticed in this sample. The water is rather turbid for a spring water.

It would be desirable to know something concerning the surroundings. If there is no near source of pollution I would approve the water, but if there is any source of pollution close at hand, I would look with some suspicion on the water for a public supply. With the nitrogenous matter almost entirely reduced to nitric acid, the indications are that the water has become completely purified in its passage through the soil. While the chlorine is not high, yet it is higher than would be expected from a good spring water under normal conditions.

E. G. HORTON, *Chemist.*

Having in view the explanatory remarks made by Mr. Horton at the close of the tabulated statement, and also the disclosures made by the chemical examination itself, and the general surface indications around this proposed source of water I would recommend the approval of this water supply for Shreve.

August 8, 1899.

Respectfully submitted,

JOSIAH HARTZELL,
Committee.

At a meeting of the State Board of Health held in Cleveland, Ohio, August 17th, 1899, the supply was approved as recommended by Mr. Hartzell, and the following communication sent to the Secretary of the Water Works.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, August 23, 1899.

Mr. D. F. Wells, Secretary of Water Works, Shreve, Ohio:

DEAR SIR: The State Board of Health has considered the application of the village of Shreve to obtain a public water supply from a spring situated about one mile from the village and which was examined by Mr. Josiah Hartzell, as a committee of this Board.

You are hereby informed that the source of the proposed water supply has been approved.

Yours truly,
C. O. PROBST,
Secretary.

By order of the Board.

REPORT UPON A NEW WATER SUPPLY FOR TROY.

To the State Board of Health:

GENTLEMEN: Having been appointed to investigate the new water supply for Troy, I visited that place on October 24th, made an inspection of the wells, got samples of the water for analysis, and having to-day received a report of the analysis I would respectfully present the following:

The original supply for the Troy water works was from a single well 21 feet deep and 25 feet in diameter, outside of the town and several hundred feet distant from the Miami river. This well was dug in 1882 but not yielding an adequate supply, in 1895 five 8 inch wells were drilled to a depth of about 40 feet, in the bottom of the large well. In 1898, the supply not being regarded as sufficient to meet the increasing

demand, five other wells were drilled along the side of the water works property, on the continuance of Main street. These varied in depth from 38 to 42 feet, the nearest about 200 feet from the original well, the farthest about 600 to 700 feet. In 1899 eight other wells were drilled along the side of the water works property bordering on the C. H. & D. Railroad, about 500 feet from the wells sunk in 1898. They are all 8 inch wells, well capped and cased to the water-bearing gravel. The soil pierced is not quite the same for any two of the wells but the extreme measurements are given below:

1. Drift or soil, 2 to 3 feet.
 2. Gravel, 4 to 12 feet,
 3. Hardpan, 2 to 10 feet,
 4. Gravel, 16 to 18 feet,
 5. Hardpan, 1 to 3 feet,
 6. Water bearing gravel, 10 to 15 feet,
- Where No. 3 was light, No. 5 was deeper.

One sample of the water was taken from the series of wells drilled in 1898 and another from those drilled this year. It was not practicable to take water from the separate wells. The samples were analysed and the results are as follows:

CHEMICAL EXAMINATION OF SAMPLES OF WATER COLLECTED AT TROY,
OCTOBER 24, 1899.

A. New wells. B. Old wells.

PARTS PER MILLION.

	A	B
Number of sample.....	807	808
Color	none	none
Turbidity	trace	trace
Sediment	trace	trace
Odor	none	none
Oxygen required	1.66	1.42
Nitrogen as Ammonia free.....	.054	.052
Nitrogen as Ammonia Albuminoid.....	.072	.029
Nitrogen as nitrates.....	.06	.41
Nitrogen as nitrites.....	trace	.001
Chlorine	1.8	1.9
Alkalinity	245.0	255.4
Incrusting constituents	11.8	11.0
Total solids	330.	351.
Volatile and combustible.....	102.	108.

These waters in general are quite similar and the results indicate they are obtained from the same or similar sources. These are not hard waters for Ohio waters.

While the nitrogen determinations and the oxygen requirement are a little higher than would be desirable, yet they certainly cannot be called high, and with

the low chlorine findings the indications are that the organic matter which does occur is chiefly, if not entirely, of vegetable origin.

From the analyses I should call them safe, potable waters. The results in sample 808 "Old Wells" may have been very slightly affected by stoppage of the pipes previously with iron rust, but such an effect if any, is but a small one.

E. G. HORTON, *Chemist*.

The three wells that proved not to be good and are not used are located quite near the pump house, while the other wells are outside of the town and surrounded on three sides by farm-land. In the direction of the town the nearest dwelling is at least five hundred feet distant.

Troy has a population of about 6000, and it is estimated that a large majority of the people use the city water. The average consumption is about 500,000 gallons and the maximum 800,000 gallons. No typhoid fever or other water-borne disease has occurred among those using exclusively the public water supply. I regard the location of the wells as safe from all sources of contamination for years to come. A hydraulic is near the water works grounds but it is shallow and the bottom well puddled and with the character of the strata through which the wells are drilled, I do not think there is a possibility of contamination from this source even if the water in the hydraulic were impure.

As the report of Mr. Horton shows the water to be safe for domestic use, I have no hesitation in recommending the approval of all of the wells.

Respectfully submitted,

BYRON STANTON,

Committee.

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY.

COLUMBUS, November 20th, 1899.

To the Board of Water Works Trustees, Troy, Ohio:

DEAR SIRs: The State Board of Health has considered your application for the approval of an additional water supply for the city of Troy, to be obtained from five drilled wells along the side of water works property on the continuance of Main street, and eight other wells along the side of the water works property bordering on the C. H. & D. Railroad. You are hereby notified that said additional supply has been approved by the Board.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board.

REPORT ON THE WATER SUPPLY OF URBANA.

Application was made to the Board by the authorities of the city of Urbana to investigate their water supply, as there was a suspicion that it was being contaminated. Accordingly, the Engineer was sent to Urbana on May 10th, to make an investigation, and following is his report:

The water works was put in by a private company in 1878, operating at present under a franchise granted July 16th, 1888. The franchise contains sections requiring the company to keep its plant in good order, to furnish adequate pressure for fire purposes, to extend its mains as required, etc., and contains the following regarding the kind of water to be supplied:

Section 15. The said Urbana Water Works Company shall, during the full term of this contract, furnish to all the inhabitants of Urbana desiring same, pure and wholesome water for domestic and mechanical use, at rates not exceeding those provided in the following schedule, to wit: (here follows a detailed list of the water rates).

The above words "pure and wholesome" are the only thing in the whole franchise which relates to the kind of water to be supplied. The plant may be purchased by the city ten years after the enlargement of the plant and its acceptance by the city, which brings it to August, 1899. In one clause the franchise states that it is in force for ten years from date of ratification, and in another clause that it is in force for ten years from the acceptance of the enlarged plant by the city. This latter date, from the purchasing clause above, is the one intended, which is August, 1899.

The capital stock of the company is \$100,000, and its value on the tax duplicate is \$63,532.

The supply is from a large well 20 feet in diameter and 23 feet deep, walled up with rough stone and covered with a conical board roof. The well goes through about 4 feet of soil, two feet of blue clay, and then through layers of gravel and sand, finding water in a layer of fine gravel 23 feet down. The level of the water varies with the local condition of the rainfall, but the supply has always been ample, except at one time in 1895. A reservoir 175x80x13 feet deep with a capacity of 140,000 gallons is used to store water in case of emergency. It is claimed it has not been used for a year at least. The sides and bottom of the reservoir are carefully cemented and practically no surface drainage has access to it. There is a tendency for moss and various growths to appear in the reservoir, and it has to be cleaned three or four times a year.

In 1895 the large well began to fail and eight driven wells were put down near it, to help out; but the large well recovered and the driven wells were pumped for only one day. The wells are all six inches in diameter, four of them are from 25 to 30 feet deep, three are 40 feet deep and one is 45 feet deep. They go through the same strata as the

large well and obtain their water in an extensive bed of gravel which continues for 150 feet down, where the bed rock is struck. These wells are all connected up and can be pumped at any time, but it is claimed that they have not been used since 1895.

The water is pumped from the large well direct to the mains by a quadruplex Holly pump of 1,500,000 gallons capacity put in in 1878 and a horizontal compound duplex Holly pump of 2,000,000 gallons capacity put in about 1889. There are 8.4 miles of mains in, giving nearly all the city access to the water. There are 900 services in use, of which 40 are metered. The average daily consumption is about 1,000,000 gallons and the average per consumer is 185 gallons.

The private water supply is from dug and drove wells ranging from a few feet to 60 feet in depth. These wells obtain their water from a large bed of gravel which underlies the whole city. This bed is composed of alternate layers of gravel, sand and blue clay. The latter very much broken and not continuous, especially in the western part of the city. In the eastern half these layers of hard pan and clay are more extensive, making several water bearing strata, one above each layer of hard pan. This large gravel bed furnishes an abundance of water, and could furnish a water of good quality if it were protected from pollution. Urbana has no sewers whatever. The surface drainage is to Dugan creek and its branches, through surface drains and gutters. Dugan creek is a tributary of Mad river. Many houses have water closets drained to or over cess-pools, which are put down into the gravel so that all the water will drain off and not fill up the cess-pool so quickly. As soon as they become full, new ones are dug and the old ones covered over. Vaults are also dug down into the gravel so as to require less frequent cleaning, or in this case renewal, as very few vaults are ever cleaned. This practice has loaded the ground water with filth, and would make well water absolutely unusable if it were not for the filtering action of the gravel and sand.

The question of the purity of the public supply is in two parts: 1st. Does the subsurface water of the city reach the supply wells? and 2nd. If it does reach it, is the water first sufficiently purified to make a potable water?

If the water does not reach the wells there is no danger. If the water reaches the wells, but only after complete purification, there is at present no danger, but at any time the water is liable to become polluted, especially as the city is growing and no sewers, to prevent further pollution of the ground water, are even contemplated.

North, northeast and east of the city is high ground forming on the north the dividing line between King's creek and Dugan creek, and on the east the line between the latter and Buck creek. This places Urbana at the outlet of a fan-shaped watershed of a few square miles in area. All the surface and subsurface drainage of this valley must leave it by Dugan creek, and the subsurface flow of the same creek. That the

direction of this subsurface flow is in the same general direction, southwest, as the surface flow, is proven by the depth at which water is found. Records of the local well diggers and drivers show that in the northern and eastern portions of the city, water is found quite near the surface and as the southwestern portion of the town is approached, the average depth of wells gradually increases, although the surface level is falling also. All wells will not show this average result, as some water may be found at any depth where it is caught by pockets in the blue clay, but the main body of water gives the above results very clearly. In the southwestern portion of the city the level of the ground water ceases to fall and a large underground lake is formed, due, no doubt, to a dyke of impervious material in the valley below which has dammed up the subsurface water.

Right in this subsurface lake, which receives the drainage from the whole city, are located the water works wells.

Just west of the water works is a large straw-board works which discharges all of its refuse into large settling basins near Dugan creek, to which the effluent flows. This plant is below the water works and probably does not pollute the supply of the latter. A well belonging to this plant lowered the water in the water works well, showing that the source of both supplies was the same, that is, the large subsurface lake.

Sample No. 1 was taken from the large well at the water works; No. 2 from the reservoir; No. 3 from the "dead end" of one of the mains; No. 4 from a live main; but No. 5 from a private well located between the center of the city and the water works. It is an old dug well about 40 feet deep and is not used a great deal now. As the deep wells at the water works were not being pumped, a sample could not be obtained from them. The samples from the mains were taken to see if the water deteriorated in them. The water from the large well should show some effect of the pollution which the ground water suffers in passing under the city. It may not seriously affect the water now, but is liable to at any time. The water from the private well should show more of this pollution, as it is nearer the source of it and the water has received less purification.

Respectfully submitted,

May 17, 1899.

B. H. FLYNN, C. E.

At a meeting of the Board held in Columbus, June 6th, 1899, this report was presented and it was decided to send a committee there to make further investigation, and Dr. Stanton was appointed for this purpose. Following is a copy of this report:

CINCINNATI, OHIO, July 7th, 1899.

To the State Board of Health:

GENTLEMEN:—Having been appointed to inspect and report upon the water supply of Urbana, I would respectfully present the following:

I went to Urbana on June 30th and with Mayor Johnson and Dr. W. Mosgrove visited different parts of the city, inspected the water works, the reservoir, the location of the public wells with reference to the city, the sources of private water supply, the manner of disposing of excrement, etc., and I can add but little in reference to them to the report of Mr. B. H. Flynn, C. E., submitted to our Board May 17th, 1899. He has fully covered the ground from an engineering standpoint and the statements made in his report are fully borne out by my investigations. Urbana has what for a long time has been regarded as a very good water supply and yet it is estimated by the superintendent of the Urbana water works that at least one-half of the people depend for their water supply upon the dug or driven wells referred to by Mr. Flynn in his report. That water from this source should be inferior would be expected in a town as old and thickly built up, where there are no sewers and where excrement is stored up in cess-pools or vaults that are seldom cleaned. That it is polluted is clearly shown by the fact that nearly, if not quite, all of the deaths from water-borne disease in the last ten years occurred in families depending upon private wells for their water.

In the last ten years there have been twenty-four deaths from typhoid fever in Urbana, one in 1889, three in 1890, two in 1891, none in 1892, one in 1893, one in 1894, eleven in 1895, three in 1896, none in 1897 and two in 1898. The year 1895 was one of unusual drought, there being a deficiency of precipitation of over ten inches in central Ohio. The supply of water in the large well, which was then the only source of public supply, was so much reduced as to excite some apprehension of failure. As eleven out of the 24 deaths of a decade from typhoid fever occurred in a year when the public water supply was so reduced it was feared that the unusual prevalence of the disease in that year was due to pollution of that supply, but on examining the records of the health office for that year I found that all of the deaths occurred in families using water from private wells, not one death from that disease occurring in families using the public supply. This would seem to corroborate the deductions made by Mr. Horton from his chemical analyses that the present public water supply of the city of Urbana is one of considerable degree of purity. While the water may have received some pollution, the agencies referred to by Mr. Flynn in his report have sufficiently purified it for domestic uses, but the growth of the city, the entire absence of a sewer system, the numerous vaults dug down into the water bearing gravel and the gradually increasing soil contamination render it improbable that this freedom from contamination can long continue and measures to preserve the purity of the supply should be at once begun.

In the first place I would call attention to the entire absence of sewers. A town as old and prosperous as Urbana ought to have a complete system of sanitary sewers and such storm water sewers as may be necessary to carry off the washing of the streets, alleys and yards, and the attention of the authorities should be called to this defect in their sanitary condition. A system of sewers completed, house and closet connections should be compulsory and all vaults should be thoroughly cleaned out and filled up.

In the second place I would call attention to the results of Mr. Horton's analyses of the water from the large well and from the mains. It seems to me that these show that some of the water from the reservoir must be pumped into the mains. I cannot account for the difference in the analyses in any other way and I would advise the abandonment of the reservoir or the laying of a separate system of pipes for fire purposes.

I would advise the annual chemical and bacteriological examination of the public water supply.

I would advise the abandonment of all private wells that give evidence of contamination on chemical or bacteriological examination.

I would further advise the immediate investigation by the health authorities of all cases of water-borne diseases, especially typhoid fever, with reference to the source of water used in the family, as in this way any deterioration of the public supply may be detected.

Respectfully submitted,

BYRON STANTON,

Committee.

Under the direction of Dr. Stanton, samples of water were collected at Urbana; one from a large well, another from the reservoir, one from a "dead end" of the water main, another from a "live main," and still another from a private well.

The results of examination of these samples were as follows:

REPORT OF THE CHEMICAL EXAMINATION OF SAMPLES OF WATER COLLECTED AT
URBANA, OHIO, MAY 10, 1899.

Laboratory No...	438	439	440	441	442
Source of sample	Large well	Reservoir	Dead end	Live main	Private well
Color	none	none	none	none	.3
Turbidity	"	"	"	"	none
Sediment	"	"	"	"	slight
Odor	"	"	"	"	sour
Oxygen required.	.52	2.18	.60	.63	3.89
N. as free amm'ia	.001	.017	.011	.011	.057
N. as albu. amm'ia	.011	.103	.034	.038	.153
N. as nitrates....	4.44	3.75	4.29	4.33	.16
N. as nitrites....	none	.044	trace	trace	.001
Chlorine	7.2	6.4	6.5	6.9	11.7
Alkalinity	299.4	221.6	286.4	285.6	286.2
Incrust. const's	none	7.2	none	none	none
Total solids	474.	416.	424.	434.	391.
Vol. & comb....	126.	48.	136.	120.	113.

REPORT ON THE PROPOSED CHANGE IN WATER SUPPLY
FOR YOUNGSTOWN.

To the State Board of Health:

GENTLEMEN:—I enclose plans and specifications for a change in the source of water supply of Youngstown.

On September 11th, I met the water works trustees, board of health and citizens of Youngstown specially interested in this question, at which time the engineer presented his report. The report of the engineers was unanimously adopted, subject to its approval by this Board, and the water works trustees were requested to take steps to carry out the project.

I would respectfully recommend that the plans for a new water supply for the city of Youngstown, submitted by the water works trustees, and prepared by Snow and Barbour, Consulting Engineers, be approved, subject to the following conditions:

a. That the stored waters of Mill creek shall not be used as a source of public water supply, without adequate purification, as recommended by the engineers.

b. That the filtration plant shall show, during a reasonable trial period, a bacterial efficiency of 98 per cent. removal without the appearance of alum in the filtered water, such tests to be made as the State Board of Health may require.

c. That a chemical and bacteriological laboratory be made a part of the plant, as recommended by the engineers, and that the filtered water be properly examined daily so long as Mill creek is made use of as a public water supply.

I would suggest the propriety of condemning the present water supply. At the Youngstown meeting Mr. Snow presented statistics furnished by the local board of health, showing Youngstown to have one of the highest death rates from typhoid fever of any city in Ohio. During the past three years 9.8 per cent. of all deaths to occur there have been due to this disease. While perhaps one-half of these are among users of wells, it is because of the bad conditions of the river water that these wells have not been abandoned. Our report on the examination of rivers shows gross pollution of the river supply. If the Board considers it proper to condemn the present supply it will probably aid in securing the necessary vote for the proposed supply. You will therefore please vote on

d. The use of the present water supply of Youngstown, in the opinion of the Board, is dangerous to public health.

Respectfully submitted,

C. O. PROBST,
Secretary.

September 18, 1899.

The report of the engineers is as follows:

YOUNGSTOWN, OHIO, Sept. 15, 1899.

To the State Board of Health, Dr. C. O. Probst, Secretary, Columbus, Ohio:

GENTLEMEN:—We submit for your approval the following scheme of an improved water supply for the city of Youngstown.

We are authorized to do this by the proper municipal authorities.

POPULATION AND CONSUMPTION.

The increase in population and water consumption is estimated as follows:

Year.	Population.	Gallons per day.
1900	52,000	4,000,000
1910	85,000	6,000,000
1920	130,000	10,000,000
1930	185,000	14,000,000
1940	250,000	18,000,000

Youngstown's prestige in the manufacture of iron and steel and the probable development of this great American industry, is the special factor that makes these estimates high, yet reasonable.

The problem is to find a source that will last forty years, being equivalent to 18,000,000 gallons daily draft.

MAHONING RIVER.

The present source, Mahoning river, has a water-shed above the water works intake of 962.8 square miles.

Its average daily yield at this point is about 800,000,000 gallons.

Its minimum flow for one month is 11.2 million gallons daily.

Its minimum flow for two months is 22.5 million gallons daily.

Its minimum flow for three months is 32.0 million gallons daily.

During these minimum times the various industrial plants on the river need all the water for their special uses.

Several times in the history of the water works a water famine has almost prevailed. Storage of the river water is absolutely necessary for a municipal supply: This storage should be large enough so as not to interfere with the flow of the river during the driest three months.

Girard dam, five miles above Youngstown, has an available storage of 360,000,000 gallons.

It might possibly be increased to 638,000,000, giving a storage sufficient only for Youngstown's consumption ten years hence.

No feasible plan for a development of the river valley above Girard has been found, and as 7,000,000 gallons is not sufficient, we have abandoned the river.

GROUND WATER.

The geological structure in the valley of the Mahoning, is unfavorable for a ground supply. The shales yield salt waters. On higher ground, from Austintown to the Boardman-Canfield road sandstones covered with drift prevail.

This territory is the only favorable one to any extent, about Youngstown.

How extensive the storage basins are, how readily they will replenish their stores, what the quality of water would be, and how much it would cost to collect it, are all unknown factors.

Even should the quantity and quality be found to be satisfactory, the cost could not be determined before hand. Riparian rights in underground waters are an important consideration. The operation of coal shafts in this vicinity drained wells for long distances, and undoubtedly the drawing of enormous quantities of water from the territory in question would destroy springs, and unduly drain agricultural lands covering an area of perhaps twenty square miles.

The consequential damages would be of no small importance.

The conservative conclusion must be that the surface source recommended of which the quantity, quality, and cost are known, is the safer source to choose.

These are the general reasons for discarding the ground supply.

MILL CREEK.

Mill creek is a tributary of the Mahoning, having its confluence within the city limits.

Its source is fifteen miles south, near the village of Columbiana, a place of 1100 inhabitants, and the only one of any size on the watershed. This shed comprises eighty-two square miles of farming land, sustaining a population, including Columbiana, of about sixty per square mile.

If the necessary storage can be obtained on Mill creek, its watershed is amply sufficient to justify its utilization. The water-shed is in its upper portion flat, but approaching its junction with the river the stream flows through a gorge which, in its abruptness and general contrast to the topography of the surrounding country, constitutes the principal attraction of Mill creek park. The upper end of this gorge is about three miles from the Mahoning. Above this point the valley widens out into the flat interval land, and the storage is practically limited to what can be obtained by dams constructed in the gorge just mentioned.

Three reservoirs can be arranged. The first by a dam at the narrows near the Mahoning river; the second at the present Cohasset lake, and the third just above Lanterman's falls.

The total storage would be 5, 542,000,000 gallons, of which 4, 524,000,000 would be available being equivalent to a daily supply of 31,500,000 gallons during the driest year.

We believe the first reservoir may never be required, the second will be a necessity sometime, and whether it shall be constructed first is a matter of policy best determined by the water trustees and city council. The third reservoir is the least expensive and gives the most storage.

The lower reservoir would contain 1,667,000,000 gallons and give a maximum draft of 8,900,000 gallons daily. The dam would be near the mouth of the creek.

The middle reservoir, called Cohasset, would contain 775,000,000 gallons, and give a maximum draft of 6,500,000 gallons daily. The dam would be in Mill creek park near the present twenty foot structure. One park road and a suspension bridge would be flooded by the project. The new reservoir would add to the attractiveness of the park. It would not interfere with the principal features of the park nor cause a waste of expensive improvements, as but little money has been spent so far on that portion which would be flooded.

The upper reservoir, called Lanterman's, would contain 3,100,000,000 gallons, and give a maximum draft of 16,000,000 gallons daily. The dam would be forty feet in height, with provisions for flash board five feet high. The surface of the reservoir with flash boards on would be at an elevation of 545. The length of the dam would be two hundred and seventy feet, and its location above the falls and park, and near the entrance of the creek to the gorge. The area flooded to elevation 545 would be 842.7 acres.

TABLE OF CONTENTS AND AVERAGE DEPTHS.

Elevation.	Contents.	Area flooded— acres.	Average depth — feet.	Per cent. of total area flooded — exposed.
545	3,100,000,000	842.7	22.4	.0
540	1,900,000,000	594.4	19.2	29.4
535	1,098,000,000	402.6	16.1	52.0
530	602,000,000	211.9	16.5	75.0
525	334,000,000	120.0	13.0	86.0

The upper portion of the reservoir would be uncovered when the water was drawn down. The lower portions of the reservoir would have steep banks and sufficient depth to make their exposure impossible. The uncovering of the upper portion can be made impossible by the construction of an auxiliary dam. This dam would be built of material obtained by stripping the reservoir below the dam and putting in a thin concrete core. It would cost, probably, about \$50,000. The level of the waste way would be at an elevation of 540 and by its construction

the surface of the water above it would be maintained constantly at this depth. The construction of this dam would considerably diminish the available storage, and until its necessity is made apparent by actual experience, it is believed to be better to omit it. Any effect shallow flowage might have on the quality of the water is to be nullified by filtration.

In the study of whether this auxiliary dam should be built at once, the capacity of the Lanterman reservoir to 540 must be used. A draft of 9,750,000 gallons daily would draw down the water thus stored to the lowest possible depth in the minimum year. Based on this draft the water would overflow the crest of the auxiliary dam 70 per cent. of the time, 80 per cent. of the time the water would be above elevation 539, 90 per cent. of the time above elevation 538, and 95 per cent. of the time above elevation 535. Or, stated differently, 70 per cent. of the time the auxiliary dam built with its surface at elevation 540 would be back flooded, and only 5 per cent. of the time, or on two occasions in twelve years, would the water drop five feet below the crest of the Lanterman dam. On these two occasions of minimum rainfall the water would drop much lower than five feet below the crest, reaching in one case ten feet. It is to be remembered that these figures are based on a draft of twenty years hence, hence it does not appear to be economical to construct the auxiliary dam at once. Calculations of the probable draft of the next ten years show that there is but little danger of the upper portions of the reservoir being uncovered sufficiently to become objectionable. Moreover, the construction of the auxiliary dam can be carried out at any time in the future by drawing down the reservoir ten feet, an operation which can be safely done at certain times of the year.

From the reservoir the water is to be allowed to run over the falls and down the creek channel, through the park to the present Cohasset lake, where a small gate house is to be built, and from there to the filtering plant the water is to be conducted by gravity through a riveted steel pipe.

COMPARATIVE COSTS AND CAPACITIES OF THE LANTERMAN AND COHASSET RESERVOIRS

Reservoir.	Minimum allowable elevation.	Available storage.	Maximum possible daily draft.	Total cost.	Cost per million gallons storage.	Cost per million gallons daily draft.
Cohasset	440	645,000,000	6,550,000	\$155,988	\$242	\$23,815
Lanterman ...	530	1,300,000,000	9,000,000	142,622	109	15,847

NOTE.—This table takes no account of the future possibility of holding water at Lanterman to elevation 545; a possibility which would make the comparison much more favorable to Lanterman.

It appears that the Lanterman reservoir is considerably cheaper, and this result would still hold good, though in lesser degree, if the conduit from the purification works were extended to this location. As a partial offset to this lesser first cost, it is a fact that the purification of the water impounded at Lanterman and drawn from an intake at Cohasset will cost more than if the new Cohasset reservoir be built immediately.

Considerations of policy, rather than engineering, must enter into the final determination of which of these two reservoirs shall be first developed. If no park were in existence, or were to be thought of, the Cohasset would be the natural choice. It will be better policy to construct this dam now and conform the park development to it, rather than to undo expensive improvements which may be added in the next ten years.

If, however, comparatively little or no money were to be spent on portions of the park below contour 470, which will be the flow line some time, then the magnificent opportunity for an extensive lake above Lanterman's falls, where sailing, boating and aquatic pastimes can be enjoyed, as contemplated and most bountifully provided for in the proposed Lanterman reservoir, may, as an immediate acquisition, amply offset a future undoing of the slight improvements absolutely needed in said portion of the park from this time on.

We have suggested a favorable consideration of the Lanterman reservoir if moderate expenditures only for the next ten or fifteen years are to be made by the park authorities in Mill creek valley. Otherwise, we recommend that Cohasset reservoir be first constructed.

PURIFICATION OF SUPPLY.

The average quality of Mill creek water during the six months of our investigation is shown in the following table:

PARTS PER HUNDRED THOUSAND.

Total solids	18.43
Suspended solids	3.58
Free ammonia .....	.0114
Albuminoid ammonia .....	.0369
Chlorine .....	.668
Nitrites .....	.0004
Nitrates .....	.0512
Alkalinity	8.14
Permanent hardness	5.74
Bacteria	3,164

Mill creek watershed contains swamps, but it is largely grazing land with gentle slopes. Human contamination is therefore indirect.

The samples were taken from Cohasset lake, and represent water subjected to sedimentation. In order to draw general conclusions the relation between the quality of the water during the months of our inves-

tigation and those of the entire year, and also of a series of years have been calculated.

We have measured the flow of the creek, noted the turbidities and then estimated the flow for different months and average years, and corresponding turbidities.

The average turbidity of all water running in the creek was thus found to be .162.

The average of our actual observations .154, maximum 1.00 and minimum .05.

The average turbidity of .162 for the creek corresponds to four parts per 100,000 of suspended solids.

These two quantities express the average quality of the creek water as it naturally flows.

Sedimentation experiments have been conducted to determine the probable quality of the water after storage in the proposed reservoirs.

The storage in the Lanterman reservoir will subject the waters from the larger portion of the watershed (seventy-one square miles) to fifty days sedimentation, but the turbidities and matters in suspension at the intake will be determined by the run off from the watershed between the Lanterman reservoir and the Cohasset dam.

While undoubtedly the waters from the upper reservoir would improve somewhat the quality of the water at the Cohasset dam, as compared with that indicated by the analyses, the effect of storms and heavy floods from the five mile watershed immediately surrounding Lake Cohasset would be to maintain the water in about its present condition. If the proposed Cohasset reservoir be constructed the waters will not be subjected to less than fifteen hours' sedimentation once each year, in which case about 30 per cent. of the suspended matters would be removed. Not oftener than once in ten years would the sedimentation be less than 20 per cent., while on the average, as already stated, 75 per cent. would be removed.

As a result of this sedimentation it is believed that with the construction of the new Cohasset, the turbidity will not average more than .075, the suspended solids 1.50 parts per 100,000 and the bacteria considerably less than 1,000.

With the use of the present Cohasset it is necessary to estimate on a water of the same quality as that indicated by the analyses, except in the case of the bacteria, which, coming in great measure from the farm lands above Lanterman dam, will be considerably removed by the sedimentation taking place in that reservoir. In short, while the bacteria will be lessened, the turbidity and suspended solids will remain as high as those indicated by the analyses.

It is estimated that with the use of the present Cohasset the factors of principal importance in the use of the water will be as follows:

	Bacteria.	Turbidity.	Suspended solids.
Maximum	20,000	1.0	50.0
Minimum	100	.02	.25
Average	1,000	.12	2.50

We have estimated the cost of purifying water of a quality like that now found at Cohasset lake.

SLOW SAND VS. MECHANICAL FILTRATION.

Experimental filters have been operated to ascertain how many gallons can be passed through sand per acre between scrapings. Our conclusions are that 60,000,000 gallons is the proper quantity for local waters.

The total solids in suspension carried by the creek for July, the least month, averaged 3.34 per 100,000, and for the greatest month, February, 9.04 was the average.

Slow sand filters would require covering as the winter temperature falls considerably below 31 degrees.

Average temperatures for the last twelve years for Youngstown are as follows:

November	40	degrees
December	33.1	"
January	27.5	"
February	29.1	"
March	36.1	"

We have taken 6,000,000 gallons daily as the capacity of the plants upon which to make comparisons.

The comparative cost of filtering Mill creek water by the two processes is as follows:

	Slow sand.	Mechanical.
Interest	\$3,575 00	\$2,535 00
Depreciation	1,460 00	2,428 00
Maintenance	8,275 00	4,500 00
Coagulant		3,372 00
Total	\$13,318 00	\$12,835 00
Per million gallons	\$6 08	\$5 86

Interest has been figured at the rate of $3\frac{1}{4}$ per cent. in each case. Depreciation has been based on a life of forty years; for masonry, buildings and other permanent structures, and a life of twenty years for mechanical filters. The estimate of coagulant is made up on the basis

of the use of aluminum sulphate. It is claimed that by the use of iron compound manufactured by recent improved methods, a considerable saving can be effected. On the above comparison, and with the possibility of obtaining a cheaper coagulant, we have recommended mechanical filtration. This process possesses a great advantage in the less land required and the facility with which additional units may be added as increased demand makes necessary. The estimates of cost are based on figures furnished us by the Jewell Filter Company, whose filter it is believed contains all the principal features of success found in any filter in the market, and some not found in any others. The most pronounced of these features, and that which led us to recommend its adoption, is the position of the sand in the tank, and the down draft or negative head. One desirable result of placing the sand near the top is that the amount of water wasted in washing is reduced. This construction also makes possible raking of the surface by reverse action of the agitator, and so increases the length of the run between washes.

The plant, as designed, includes two steel sedimentation tanks, to which the water from the storage reservoirs on Mill creek will flow by gravity. These tanks, with the filter house, it is proposed to locate on the pumping station lot on Northwest avenue. The filter house, which is to be a substantial structure of brick 44x212 feet, will contain six 24-foot filters. These are the largest size mechanical filters now constructed and have an area of 1/100 acre. The depth of sand in these filters should be four feet, an amount which will render variation in the quality of the effluent less probable. The tanks are to be constructed of steel, and the structure will be much more permanent and more easily kept clean than if built of wood.

The chemical is to be pumped into the sedimentation tanks, and the coagulated water then flowed to the filters by gravity. The water after being purified flows to the clear water reservoir, situated under the filter house. Pumps for washing the filters will be provided and the waste water removed and will enter the sewer and be discharged into the Mahoning river. The outside sedimentation tanks will make possible more efficient sedimentation, and increase the capacity for filtration between washings, and reduce the waste. The agitating device will be especially heavy and designed to stand rough usage. The filters will be provided with the latest regulating device and automatic indicators.

The bacteria are much less at Mill creek than at Pittsburgh or at Louisville. The suspended solids are about the same as at Pittsburg, and about one-tenth those at Louisville, and the alkalinity greater than at either of these places.

Mr. Fuller, at Louisville, recommended mechanical filters, because of the large amounts of suspended matter present in the water. Clarification of such waters guarantees bacterial efficiency.

Mr. Hazen, at Pittsburgh, concludes that slow sand is safer from a bacterial standpoint than mechanical filtration, and that while the amount

of matters in suspension will not increase in the future, the growing population will inevitably increase the number of bacteria in the water, and therefore, slow sand should be recommended.

It is also to be noticed that at Pittsburgh the amount of chemical which could be used was limited to the alkalinity. At Mill creek the bacteria are low, and are probably, for the most part non-pathogenic. The alkalinity is sufficiently high to decompose any amount of chemical which may have to be used.

We have estimated on an average of .85 grains of sulphate of alumina per gallon of water cleaned, to clarify and guarantee a bacterial efficiency of 98 per cent.

You will observe that the average alkalinity is 8.14 and the permanent hardness is 5.74; for the river the alkalinity is 6.16 and the permanent hardness 6.96.

Mill creek water has naturally less incrustating and corroding constituents than the river water. The decomposition of the coagulant will increase the permanent hardness of the creek water, but even so, it will then be more desirable than that now supplied to the city consumers, that is, it will be a softer water.

The quantities of sulphate of alumina required for different bacterial efficiencies, and for varying turbidities by the Jewell filter was determined by Mr. Hazen at Pittsburgh.

- .42 gr. per gal. gave 95% efficiency for turbidities up to 0.07.
- .49 gr. per gal. gave 96% efficiency for turbidities up to 0.12.
- .65 gr. per gal. gave 97% efficiency for turbidities up to 0.21.
- .96 gr. per gal. gave 98% efficiency for turbidities up to 0.39.

The alkalinity of the creek makes over six grains of sulphate of alumina permissible, so that no apprehension of an inferior water on account of the use of the chemical need be entertained. There may be extreme cases when for a day three or four grains per gallon may have to be used.

Our estimates of cost include the erection of a laboratory at the filtering plant, and the permanent employment of a competent chemist and bacteriologist to conduct the works. The guarantee we have named is to be required of the Jewell Filter Company, and its fulfillment determined by us and the said chemist and bacteriologist, it being understood that we, the undersigned, acting as experts for the water trustees, shall conduct such tests as may be required and directed by your Board.

The clear water basin under the filter house is to hold about 600,000 gallons. The present standpipes are to be used in connection with the pumps to equalize fluctuations in consumption caused by fires for any part of the city, and for domestic purposes for the high service. The fluctuations for the low district are to be met by the pumps and small clear water basin for the immediate present, but in the near future by 1,500,000 gallons storage on the hill. This reservoir is to be covered.

circular, masonry structure, and located on city land near the north standpipe.

The total cost of the scheme is as follows:

Reservoir and accessories.....	\$160,000
Pipe line, intake, etc.....	85,000
Filter plant complete, and buildings.....	77,000
Clear water basins and connections.....	16,000
Distributing system and contingencies.....	12,000
Total	\$350,000

The water trustees may, on account of incidentals, ask for a larger bond issue than the above sum. The scheme as herein outlined, has been unanimously accepted by the water trustees, city board of health and the mayor, subject to the approval of the State Board of Health, and a resolution was adopted declaring that steps be taken, as soon as word should be received from the State authorities, to bring the matter before the voters at the coming election.

As there are weeks at a time when no chemicals would be required if danger from pathogenic organisms were removed, it has been thought desirable to ask for legislation whereby the State Board of Health shall have supervising authority over the occupation of Mill creek watershed, and you are further requested to give this matter consideration. In any event, legislation will be sought to allow the undertaking of the project, as it may be returned to us from your Board.

Respectfully submitted,

SNOW AND BARBOUR,

Engineers.

APPROVAL OF PLANS FOR A NEW WATER SUPPLY FOR YOUNGSTOWN.

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY.

COLUMBUS, September 23, 1899

To the Water Works Trustees, Youngstown, Ohio:

DEAR SIRs:—The State Board of Health has considered your request for the approval of plans, prepared by Messrs. Snow and Barbour, Engineers, for a new source of water supply for your city. The plans provide briefly for impounding the waters of Mill creek and purifying them by means of mechanical filters.

We wish to officially commend the action of your board in planning to abandon the present water supply from the Mahoning river, and for the care that has been exercised in giving a proper study to the question of securing a new supply that will be satisfactory.

The State Board of Health considers that the use of the unpurified Mahoning river water is a constant menace to the health of the citizens of Youngstown, and has officially condemned that supply. The plans proposed for a new supply have been submitted to the Board, and you are hereby notified that they have been approved, subject to the following conditions:

a. That the stored waters of Mill creek shall not be used as a source of public water supply without adequate purification.

b. That the purification plant shall show, during a reasonable trial period, a bacterial efficiency of 98% removal without the appearance of alum in the filtered water; such tests to be made as the State Board of Health may require.

c. That a chemical and bacteriological laboratory be made a part of the plant and that the filtered water be properly examined daily so long as Mill creek is made use of as a public water supply.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board.

SEWERAGE SYSTEMS AND SEWAGE DISPOSAL WORKS.

APPROVAL OF PLANS FOR CHANGES IN THE SEWERAGE SYSTEM FOR THE CLEVELAND STATE HOSPITAL.

BOSTON, MASS., Feb., 1899.

To the Trustees of the Cleveland State Hospital:

GENTLEMEN:—In accordance with your wishes we have made an investigation of the sewage of the Cleveland State Hospital, and beg leave to submit the results of the examination of present conditions and our conclusions as to the best method of providing your Institution with an efficient system of sanitary and storm sewers, together with estimates of cost of the necessary work.

Respectfully,

SNOW AND BARBOUR.

PART I.

GENERAL CONSIDERATIONS OF SEWAGE.

Section 1. The gathering of mankind in communities makes necessary the removal of the storm water as well as of the sewage. Whether this removal should be effected through a single system of pipes, or through two systems has long been a fertile subject of discussion. Of late years the increased necessity for some method of purification has tended toward a greater use of the separate system, because of the economy of limiting the amount of sewage to be treated to as great an extent as possible. Where disposal is by dilution, however, this consideration has less weight, and the final decision must be based on the relative economy of the separate and combined systems, and also on the ratio between the dry weather flow and the storm discharge to be handled.

If the point of final deposition is the same for both sewage and storm water the combined system is usually the cheaper, and the only argument which may be brought against its adoption is with reference to the possible unsanitary conditions resulting from the low velocity of the dry weather flow in passing through pipes designed for maximum storm discharge.

Section 2. The design of a system planned to carry sewage alone is based upon the number of people contributing to the sewers and the daily consumption of water, with an allowance for fluctuation in the

flow at different hours; and also, in view of the necessary ventilation of the sewers, with a limitation of the flow line to a portion of the total diameter of the sewer. The minimum flow, in hospital systems, will average about one-fourth of the maximum, and in pipes, designed to flow one-half full with maximum discharge, the velocity in times of minimum flow will be two-thirds of that during the greater discharge; or, if the grade is properly proportioned, sufficient in all cases to be self-cleansing.

Section 3. The basis of design for a combined system is the maximum run-off from the territory draining to the sewers which it is economical to consider as possible. This maximum run-off is determined by the maximum rainfall in the time necessary for all the area to become contributory to the sewers, and by the size and nature of this area.

It is usually unnecessary to consider the flow of sewage in connection with the maximum discharge, as it is relatively so small compared with the storm water, as to have little effect on the design. The amount of sewage is, however, often the determining factor in the advisability of adopting a combined system. The velocity in any pipe decreases with the depth of flow, and when the flow of sewage is so small, compared with the maximum storm discharge, upon which the size of the conduit is based, as to result in a velocity too slow to be self-cleansing, the adoption of a separate system becomes advisable.

Section 4. Variation in the height of flow line and the consequent changes in velocity and the liability of stranding of the heavier portions of the sewage, make some provision for flushing necessary. In the combined system, the expense of artificially flushing large conduits usually results in a reliance on the storm discharge to cleanse the sewers; the necessity for a self-cleansing velocity during minimum dry weather flow is apparent. The small pipes of a separate system can be economically and effectively flushed either by the use of automatic tanks, or by a connection with the system of water works.

Section 5. The most efficient flushing will not entirely prevent the soiling of the sewers to some extent. The mucous scum which clings to the pipes is constantly decomposing, and in order to make this action inoffensive a plentiful supply of oxygen in rapid circulation is necessary.

Various methods have been proposed for the ventilation of sewers, but the most effective is that whereby fresh air is drawn into the sewers through frequent openings in the surface of the ground, and discharged through uptakes at an elevation where the outflowing gases can do no harm. Perforated manhole covers and house connections without any main trap furnish these desirable conditions. The soil pipe, warmed by its passage through the house, forms an efficient uptake for the length of sewer with which it connects, and the fresh air drawn through the manhole cover purifies not only the air of the sewer but also of the house

pipes, maintaining a continuous circulation and making impossible the forcing of fixture traps. The movement of air in the sewers, which can be effected by the draft through the soil pipes, depends upon the relative area of the sewer and soil pipe, and it is apparent that the ventilation of a system of small pipes is much more easily accomplished than that of the larger pipes of a combined system. The advisability of utilizing the soil pipe as an uptake for the ventilation of the sewer assumes that the plumbing inside the building is in good condition.

Section 6. In the design of sewers consideration must be given to both the maximum and minimum discharge.

Even with the best proportioning, more or less fluctuation in the flow will take place, and some system of flushing is necessary in order to keep the sewers clean, especially in dry weather.

The inevitable decomposition of the scum in the cleanest sewers makes imperative thorough ventilation, in order that this action may be effected inoffensively.

Having briefly considered the general premises of sewerage design, the discussion of the problem in relation to the Cleveland State Hospital may now be entered upon.

PART II.

PRESENT SYSTEM.

Section 7. The Cleveland State Hospital is situated between Turney Avenue and Broadway. This institution consists of one large hospital building facing northeast, with wings running to the north and south, and of two detached buildings—one for male and the other for female patients, besides numerous other outbuildings. Mill creek runs between Broadway and the main building flowing to the west. At the point where the stream enters the land of the State a piggery and slaughter house are located, and along its banks are several buildings. The larger part of the territory drains into Mill creek. The cottage for male patients lies about 300 feet to the southeast of the main building, while that for female patients is situated about 400 feet to the northwest of the main building and a short distance from Turney Ave.

Section 8. The present system of sewers (See plate No. 1) consists of a main drain of stone and pipe of various sizes, beginning at the male cottage at a depth of six feet, and passing by a sudden drop of three feet under the south wing of the hospital building, crossing in front of the main entrance ten feet below the surface, passing under the north wing where it is fourteen and five-tenths feet deep, and thence in a north-westerly direction about 1,870 feet to the edge of a precipitous bluff over which it is carried in a wooden box chute to the brook below. This brook is not of sufficient size in dry weather to properly dilute the sewage of so large an institution, and the outlet is offensive as a natural

consequence. The main sewer intercepts laterals from the cottage for female patients, the laundry and workshop, and three from the hospital building. Besides the sewage these drains receive all the roof water from the main building, and also the surface drainage from about nine acres around the hospital, principally in the rear. The water from the roof enters the sewer by overflows from three large cisterns, from which water is taken for laundry purposes.

The laterals from the hospital buildings are almost entirely beneath the floor of the basement, the soil pipes from the rear wings being conducted into catch basins, and thence at a right angle into the basement of the adjoining ward, where these pipes enter into the lateral sewer. The lateral from the workshop passes by a devious route under the basement of the laundry. All waste water from the boiler and engine house is carried to the brook by an independent drain which intercepts the sewage from the amusement hall. The hog-pens, which consist of two modern sanitary pens, are arranged so that their washings are intercepted and discharged through an 8 inch pipe on the hillside eighty feet away.

Section 9. The discussion of the capacity of the present system of sewers, which as already stated are designed to take both the sewage and rain water, may be based entirely upon the amount of storm water, as the relative quantity of sewage is so small as to make its consideration unworthy of notice. The amount of storm water which must be taken care of will be considered in greater detail further on in this report, and for the present it may be stated that the total maximum quantity may reach as great an amount as 26.0 cubic feet per second, reducing from this quantity to 7.17 cubic feet per second at the upper end of the system.

The following table shows the sizes and grades of the present sewers, together with their capacity, and also the probably maximum quantity which may, during extreme storms, require removal.

TABLE NO. 1.

Location of sewer.	Length of sewer —feet.	Size.	Grade.	Capacity cubic feet per second.	Maximum run-off cubic feet per second.
N. W. cor. hospital to 1st manhole	280	2'x2'	1.47%	28.1	17.0
1st to 2d manhole.....	100	14" & 15"	1.70%	9.8	16.0
2d to 3d manhole.....	104	16" & 12"	.29%	4.0 & 1.8	15.0
3rd to 4th manhole.....	202	12"	1.04%	3.5	14.0
4th manhole to east side hospital..	65	12"	.61%	2.7	12.0
East side hospital to male cottage.	356	8"	2.53%	1.8	10.0

A comparison of the last two columns indicates that accepting as correct the assumption upon which this table is based, the present sewers are not of sufficient size to discharge the possible storm water run-off without more or less back-flooding. The 2 feet x 2 feet box drain is capable of discharging the maximum run-off, but a rainfall of 2 inches per hour would cause the water to rise above the catch basins, flooding the grounds and basement.

A rainfall of 1.5 inches per hour will, according to our calculations, flood the laundry, and in all heavy storms the cottage for female patients and the sewers south of the main entrance are likely to be flooded.

Past experience is valuable in estimating necessary future assumptions, but it is to be remembered in this connection that heavy storms usually cover only a limited territory, and therefore it is not entirely safe to rely on experience to too great an extent.

Without going into a further discussion of this portion of the subject, it is evident that from the standpoint of capacity the present system is inadequate to meet the probable necessities of storm water discharge.

Section 10. In Part I of this report the determining factors of success in sewer design have been indicated as—a proper proportioning of sizes of sewers to maximum and minimum flow, and the provision of an adequate system of flushing and ventilation.

The box drain portion of the main sewer is the most dangerous from a sanitary standpoint. Its capacity is such as to make the velocity in times of minimum flow practically nothing, and the distribution of the sewage over the flat bottom tends to arrest matters in suspension and make possible, before the next flushing the formation of dangerous gases.

That the present sewers appear to be comparatively clean is owing to the excellent grades, upon which the conduits are laid, and to the periodical flushing provided in time of storms; but that the sewers are clean at times does not deny the possible existence of sludge deposits for considerable periods of dry weather, when the surrounding soil and air become permanently saturated with the emanation of putrefaction.

The main sewer is provided with four manholes of poor design, all bunched together within a distance of four hundred feet of the main building. These manholes are built with a sump three feet below the sewer and acting as a settling tank for the heavier particles of the sewage, they are consequently very foul. Although these were supposed to have been cleaned out a short time previous to our examination, from two to three feet of sludge was generally found in them. Owing to the mode of construction it is extremely difficult for the flood flow to flush them out thoroughly, and while the sewers after storms may appear clean, more or less of the sludge remains behind in these sump holes. A similar manhole is placed near the laundry in the lateral serving that

building, and one in the sewer leading to the cottage for female patients, within a few feet of the main pipe. Near the cottage is a brick chamber inclosing a trap in the sewer, and a similar arrangement is found near the cottage for male patients. The catch-basins into which the soil pipes from the rear wings are laid are of such a size that the velocity of the sewage in passing through them is greatly reduced, and sludge accumulation is inevitable.

In all of these structures the design is directly contrary to what modern ideas of sewerage would indicate to be correct. To carry the sewage as rapidly as possible to the ultimate point of deposit, through stoneware pipes carefully laid, with smooth joints and without any sumps or other enlargement tending to arrest the movement of the heavier matters of the sewage are primary considerations. The existence of these manholes with sumps, and these catch basins and traps, is undoubtedly a menace to the health of the Institution. In the first part of this report the necessity for flushing has been alluded to, and it was there stated that this depends in great measure upon the relation between the amount of the maximum and minimum flow in the sewers. While the storm water undoubtedly serves a good purpose in this direction in the present system, there cannot help but be periods of considerable length when not only in these sumps but throughout the entire system sludge deposits must form and gases of putrefaction must result.

The statement has also been made that the danger of these gases depends largely upon their formation in an atmosphere devoid of oxygen and without movement. The covers of the present manholes are of stone, with an opening of about 15 in., over which a tight iron cover is fitted. The soil pipes are all provided with a main trap, and it is therefore apparent that the movement of the air in the sewers must be extremely limited and the available oxygen rapidly used up, and in periods of minimum flow the sewers must be more or less full of gases dangerous to the health of the Institution.

Two large grease traps intercept the flow from the kitchen and from the butcher shop. The opening into the inclosing structure is not of sufficient size, and the difficulty of properly cleaning the traps makes their maintenance difficult and increases the probability of neglect.

The pipes passing under the buildings are of stone and vitrified clay. Such material cannot be made sufficiently tight to prevent the gases in the sewers from passing up into the basements. It is a mistake to suppose that a cement floor is a protection against this danger.

Section II. An examination of the present system of sewers leads to the conclusion that the pipes are not of sufficient capacity to discharge the possible run-off from heavy storms; that the pipes are of such sizes and design as to make probable the formation of sludge deposits during periods of minimum flow, which naturally give off dangerous gases and that these gases may pass through the basements into the buildings

of your Institution; that there is no provision for ventilation and an extreme lack of facilities for cleaning and inspection; that the grease traps are difficult of access and without ventilation; and that the man-holes are poorly constructed and located. In short, the entire absence of systematic design indicates the necessity for improvement of the present system.

The question at once arises—can the system be overhauled and placed in a sanitary condition, or is it better to abandon the present work entirely and construct a new system of sewers? These alternatives will be separately discussed in the following portions of the report.

PART III.

IMPROVEMENT OF PRESENT SYSTEM.

Section 12. The outlet of the sewer system of your Institution in the future is to be into a large brick sewer of the city of Cleveland, in Turney Avenue. The cottage for female patients is to be directly connected with this sewer and need not be further considered.

The outfall sewer should be replaced by a 24 inch pipe, in which a trap should be installed near the said sewer to shut off the gas from the larger system. The sewer from the main entrance to the south side of the building should be replaced by an 18 inch pipe on a proper grade. All sewers passing under the basement floor must be replaced by cast iron pipe, the 2 ft. by 2 ft. stone drain under the north wing by a 20 inch cast iron pipe, and the others according to the necessary capacity.

Section 13. The manholes should be filled with concrete to a point 4 in. below the sewers, and a brick invert or channel constructed to conform in shape and size to the lower half of the pipe, thus affording a free passage for sewage and an opportunity to inspect and properly care for the sanitary condition of the sewers. The upper portion of the present brick work should be taken down and rebuilt in such a manner that a modern perforated cover with a two-foot aperture can be placed directly over the masonry. This should be provided with suitable locks to prevent the introduction of obstacles by inmates or malicious persons.

A manhole should be constructed at the trap south of the hospital, and the trap should be removed from the sewer near the cottage for male patients and a manhole constructed at that point. A manhole should be placed where the laundry branch is intercepted. The grease trap should be reconstructed in such a manner as to provide easy access for cleaning.

Section 14. Some provision should be made for flushing the sewers during periods of dry weather. Automatic flush tanks would be of small value unless constructed at frequent intervals along the main line, and the best results can probably be obtained by connecting with the water

system. Such a scheme will, however, be expensive, in view of the sizes of pipe to be flushed.

Section 15. Better ventilation of the system should be provided for by, as already stated, using perforated manhole covers as inlets for fresh air, and the removal of traps in the main lines and branches so as to allow free draft from the sewers through the soil pipes to the atmosphere above the roof.

Section 16. An examination of these changes, which are deemed absolutely necessary in order to put the present system in a fair sanitary condition, makes it evident that they involve practically the construction of a new system.

Even should these changes be made, inspection would be impossible at some points on account of the irregular way in which the pipes are laid; the undesirable location of the manholes about the main entrance would not be avoided; the laterals under the buildings would be difficult of access for inspection and repair, and even with the use of iron pipe their location is undesirable.

By the proposed changes the present system would be greatly improved, but in view of the cost necessary to effect these improvements it is believed to be more economical to rebuild the entire system.

PART IV.

DESIGN OF NEW SYSTEM OF SEWERAGE.

Section 17. In the study of the design of a new system the consideration of the amount of sewage and storm water to be removed by the sewers will be taken up in greater detail than has already been done.

The present population of the Cleveland State Hospital is about 1,150 people. The daily consumption of water is about 120,000 gallons, plus the amount taken from the city supply for drinking purposes, and that drawn from the cisterns for use in the laundry. The daily consumption per capita is, therefore, a little over 100 gallons. We have been informed that it is not likely that any considerable addition will be made to the institution, and the future population has been assumed at 1,500 people, the daily consumption at 100 gallons per capita, and the total quantity of sewage to be handled at 150,000 gallons.

In calculating the necessary size of pipes the variation in rate of flow must be taken into account. Experience at other hospitals has shown that the maximum flow may be safely estimated by assuming that five-eighths of the total daily discharge flows off in eight hours. On these premises the future maximum flow of sewage will be 0.43 cubic feet per second, and the minimum 0.13 cubic feet per second. An 8-inch pipe on a 0.6% grade, when flowing one-half full, will discharge this maximum quantity with a velocity of 2.5 feet per second. The minimum flow of 0.13 cubic feet per second would in this pipe

flow with a depth of 2 in. and a velocity of 1.6 feet per second. As experience has proved that a velocity of 1.5 cubic feet per second will keep a well laid pipe clean it is apparent that the minimum flow of sewage will, in an 8 in. pipe, produce a velocity which will be self-cleansing.

Section 18. The problem in hand involves, besides the removal of the sewage, the necessity of some provision for removal of the storm water. This is a less determinate problem than the flow of sewage. Rainfalls do not occur regularly and in uniform amount. The maximum storm which is liable to occur is the one which will do the most damage, and therefore the one upon which the design of the system must be based. There is a limit beyond which it is not economical to insure, the annual charges of providing for the extreme case being more than the possible damage at intervals of many years. On the other hand, experience can only be relied on within certain limits, and because a storm beyond a certain rate has not occurred is no proof that it will not occur. Heavy rainfalls extend, usually, only over limited areas, and in estimating future possibilities it is advisable to base the design upon records of automatic gaugings of rainfall taken in the vicinity of the system to be constructed. The rate of precipitation is greater for short periods of time, and the maximum rate which it is necessary to assume in design depends upon the length of time necessary for all the area draining to the sewers to contribute water to the pipes.

In the present case, a study of the problem has made it apparent that the entire area will be contributing in about twenty minutes, and the rate of rainfall upon which the calculation is based has been taken as that which is known to have fallen in the vicinity of Cleveland in this time. Without going further back than 1896, there are two records of storms in Cleveland when rain fell for twenty minutes at a rate exceeding 3.25 in. per hour, and a study of the rainfall records indicates that storms with a precipitation as great as 3.5 in. in twenty minutes will occur about once in twelve or fifteen years.

This period is certainly within the time which it is economical to consider, and a possible rainfall of 3.5 in. per hour has therefore been assumed.

The area draining into the system is composed of nine acres of ground surface and two and ninety-five hundredths acres of roofs. It is assumed in the calculations that all water falling on the roofs, and fifty per cent of that falling on the ground surface will reach the sewers during the period of precipitation. The following table shows the results of calculations on these premises, and also the grades and necessary size of sewers, based upon the proposed design of the new system. (See Plate No. 2.)

TABLE No. 2.

Location.	Roofs.		Ground surface.		Total discharge cubic feet per second.	Available gaade.	Necessary size of pipe.
	Area, acres.	Discharge cubic ft. per sec.	Area, acres.	Discharge cubic ft. per sec.			
Main sewer below 1st br'ch	2.95	10.32	9.0	15.75	26.07	1.25	24 in.
1st to 2d branch.....	2.30	8.05	8.5	14.87	22.92	1.10	24 in.
2d to 3d branch.....	1.05	5.25	8.0	14.00	19.25	.70	24 in.
3d to 4th branch.....	.80	2.80	4.0	7.00	9.80	.50	20 in.
4th branch .....	.80	2.80	2.5	4.37	7.17	.50	18 in.

The necessary sizes of pipes are figured to carry the discharge when flowing full.

Section 19. It has already been shown that the flow of sewage proper will vary from a minimum of 0.13 cubic feet per second to a maximum of 0.43 cubic feet per second, and that a possible storm flow will reach a maximum of 26.0 cubic feet per second, necessitating in the latter case a pipe 24 in. in diameter. The factor which will determine the future sanitary condition of a system of pipes designed to carry both the sewage and storm water will depend upon the ratio between the flow of sewage proper and that of storm discharge for which the pipes are necessarily designed. Making this comparison, it is found that the minimum flow of sewage is about one-half of one per cent. of the maximum storm discharge, and that in a 24 in. pipe its flow will result in a depth of less than one inch and a velocity which will be considerably less than one foot per second, or less than that necessary to keep the sewer in a sanitary condition. This calculation is based on the largest pipe of the system, and the maximum quantities flowing from the institution. A consideration on the same basis at points further up the system shows the same result, namely, that in a system designed to properly take care of the storm water the minimum flow of sewage proper will result in velocities not self-cleansing.

It is, therefore, apparent that if a new system is to be installed at your institution the sewage and storm water should be removed in separate pipes, the pipes for sewage being calculated to flow one-half full when carrying maximum discharge, and those for storm water to flow full when working under like conditions.

The separation of these systems will involve but a limited increase in costs over that of a combined system; the pipes will be placed in the same trench, and the expense will involve merely a limited widening of the trench and the cost of the extra small pipes. The advantages from a sanitary standpoint are many, and have been already described in preceding sections of this report. The separation of the two systems

will eliminate the present danger of connecting the cisterns with a system carrying sewage; it will make possible a better circulation of air through pipes, and it will make flushing less necessary and more economical.

Section 20. In laying out a system of pipes, the first consideration is the number and location of the buildings to be provided for. The cottage for female patients will be connected directly with the city sewer. The amusement hall is too low to be considered, as are also the power and boiler houses. The stable is soon to be moved some distance to the south, so no sewer has been designed for it, but provision will be made for drainage at its new location. The remaining buildings which must be taken care of are the hospital, laundry, workshop, male cottage, and the slaughter house and pig pens.

In estimating the area of ground surface, that portion south of the roadway which passes to the north of the male cottage has been disregarded, as it naturally drains to the brook, and the territory figured is that immediately surrounding the main buildings, amounting to—as already stated—nine acres.

A glance at the plumbing fixtures of the hospital shows that with few exceptions they are so placed as to be most accessible from the rear. This fact, and the position of the other buildings indicates that the proper place for a sewer intended to serve all, is behind the hospital. Most of the surface drainage is intercepted in this location. As the largest number of connections come from the main building, the sewer should be as close to this building as possible, and the contour of the ground, together with the arrangement of paths indicates that a line passing forty feet to the rear of the end wings will be most economically located. This is as close to the building as it is advisable to place man-holes.

The arrangement proposed consists of a double line of piping laid in the same trench, as shown on Plate No. 2. The drain for surface water starts from the city sewer on a grade of 1.25%, at the point where the present outfall crosses Turney Ave.; skirts the edge of the street for a distance of about 145 feet, where the branch from the north wing of the hospital is intercepted; thence continuing, on a grade of 1.1%, to a point 40 feet west of the hospital, intercepting on its way a branch from the north end of the building; thence continuing on the same grade to a point northwest of the kitchen, where the connection from the laundry and the second branch from the hospital are intercepted; thence on a grade of 0.7%, passing under the tunnel to a point southwest of the butcher shop, where the third branch is received and the size reduced to 20 in.; thence a 20 in. pipe on a 0.5% grade to a point 40 feet west of the southwest corner of the hospital; thence along the southeast end of the hospital an 18 in. pipe on a .5% grade to a manhole where the present sewer from the cottage for male patients will be intercepted.

The sewer pipe, which will be laid in the same trench as the line already described is to be throughout an 8 in. pipe on a 0.6% grade.

The first branch will consist of two lines of 6 in. pipe on a 1.5% grade, which will pass under the north wing of the hospital and extend to the center of the building to provide for the fixtures there located and also to receive the drainage from the inner court.

The second and third branches will be double lines of 8 in. pipe laid on grades of 2.0% and 0.7%. A pipe will be laid from the manhole at the upper end of the 8 in. pipe under the south wing of the hospital to receive the roof water from the front of the building. This and the first branch will be the only pipes passing beneath the basement, except the connections from the various fixtures, which will be taken outside by the shortest possible route. All pipes laid under the building will be of heavy cast iron with lead joints, to a distance several feet outside the walls.

It is proposed to lay a new 6 in. sewer to the cottage for male patients, retaining the present sewer from this building as a carrier of surface water from the roof and surrounding area.

The hog pens are about 14 feet higher than the sewer at the manhole near the cottage for male patients, and the contour of the ground permits the construction of a drain to take the waste from these pens and also from the slaughter house at small expense. It is therefore proposed to extend the sewer which provides for the cottage for male patients to the hog pens. The average cut will be small, and this method of disposing of the wastes from these buildings is the cheapest which can be arranged. The plan and profile of this sewer is shown on Plate No. 3.

All sewers will be built of vitrified pipe of the best quality, rigidly inspected to prevent the use of defective material, the joints being carefully made of neat Portland cement.

Manholes will be placed at all changes of line and grade and at the interception of all branches, to provide an opportunity for inspection. Both systems of piping will be taken through these manholes, and the details of their construction are shown on Plate No. 4. Perforated manhole covers of approved design will be used, and it is recommended that the traps be removed from the house connections, and the soil pipes extended above the roof. No trouble from gas in the buildings need be anticipated if the soil pipe has a clean, full-sized opening through the roof, and the house fixtures are provided with traps before entering the soil pipe.

The catch basins and all roof drains, except those which supply the cisterns, will be connected with the system of surface drainage. The overflows from these cisterns, suitably trapped, will discharge into the drainage system.

Flushing of the small sewer system will be provided for by connecting with the water pipes at the slaughter house, and at the upper end of the first branch, near the front entrance of the hospital. These connections are simply 1.5 in. pipes running into manholes, and furnished with a stop cock to be opened when necessary. This system is more economical than the use of flush tanks, and properly handled, more efficient.

A special design for a trap on the 24 in. main line, to prevent the entrance of gas from the city sewer, is shown on Plate No. 4. This will be constructed in the manhole at the north end of the system.

The Plate of details also illustrates a design for the improvement of the grease traps. The inflow and outflow pipes are arranged to enter the chamber with a double Tee bending down, the ends of both being below the water line of the trap. The top of these Tees will be left open, that of the inflow being carried above the surface of the ground to provide a circulation of air. The opening opposite the end of the pipes will be sealed, but will make possible the cleaning of the pipes in case of need, without removing the Tee. These chambers will be covered with stone, having a two foot opening fitted with a regulation manhole cover, and a ledge of brick will be built on either side above the water line, thus providing a foot-hold for the purpose of removing the grease, which should be done at frequent intervals. The grease should never be allowed to accumulate to a greater depth than one-half the seal of the trap.

Should the construction of a new system of sewers be determined upon, it will become necessary to thoroughly flush, disinfect and fill up the old sewers with grout or thin mortar, to prevent their remaining as chambers for decomposition and the formation of dangerous gases. The abandoned manholes should also be filled up.

Section 21. The estimate of cost is as follows:

Main sewer from city sewer to upper end of 18 in. pipe.....	\$2,462 65
New sewer to cottage for male patients.....	138 25
Piggery sewer, from cottage for male patients to pens.....	752 30
First branch	409 50
Second branch	161 40
Third branch	174 20
House connections	575 00
Roof drain connections	200 00
Catch basins	100 00
Grease traps	100 00
Filling up old sewers.....	200 00
Repairs to plumbing.....	500 00
Flushing apparatus	20 00
	<hr/>
	\$5,793 30
Add 15% for contingencies.....	869 00
	<hr/>
Total	\$6,662 30
11 BD. OF H.	

The preceding estimate is based on the assumption that the work will be done by contract. The figures are what our experience has proved to be liberal, under good management, and it is believed that the work can be done within this estimate.

If all excavation and back filling of the trenches were done by the patients at the institution, the total cost would be reduced \$2,073.57, and if all house connections and the filling of the old sewers were also done by the inmates, a reduction of about \$900 more would be made possible. In other words, if the handling of earth work and such labor as can be done with unskilled labor were carried on by the inmates of the institution the cost of the system might be reduced to about \$3,700. One month should be sufficient for a competent contractor to do the entire work, but a longer time will be necessary if the labor of the inmates is utilized. In the first case, it would be necessary that a resident engineer be continually on the work to attend to the proper staking out, grading and construction of the system, to insure the attainment of a good work; in the latter, periodical visits of the engineer and the employment of an expert foreman would in all probability be sufficient.

PART V.

RESUME OF REPORT AND RECOMMENDATIONS.

Section 22. To sum up the report, our investigations have proved that the present system of sewers is inadequate in capacity to carry off the storm flow, which gaugings of rainfall in the vicinity of your institution indicate to be possible; and that the construction and design of the sewers and manholes is extremely ill-considered from a sanitary standpoint. It is believed that to put the present system in thoroughly good condition would require an expenditure practically equal to the cost of a new system; that when completed it would not be satisfactory; and that therefore the reconstruction of the present system is not advisable.

Studies of the sewage and storm water discharge have made apparent the advisability of providing separate systems of pipes for their removal, and that this can be done at a comparatively small expense.

Section 23. It is, therefore, recommended that a new system be constructed on the plan described in the preceding report; that the old sewers and manholes be filled up where there is danger of contaminating the air of the institution; that special care be taken during the construction of the new system; and that detailed specifications be made before the work is commenced. If, in the opinion of your board, a sufficient number of the inmates are available to make possible the handling of the earth work, it is recommended that such labor be done by the patients.

It is also suggested that the work of overhauling the old plumbing in the various buildings be continued, in order that a complete sanitary condition may be established.

Respectfully submitted,
SNOW & BARBOUR.

At a meeting of the State Board of Health held in Cleveland on August 16th, it was voted to approve plans for changes of the sewerage system of the Cleveland State Hospital as presented by Messrs Snow and Barbour, consulting engineers.

APPROVAL OF PLANS FOR PURIFICATION OF THE SEWAGE OF THE FAIRMOUNT CHILDREN'S HOME.

At a meeting of the State Board of Health held in Cleveland, Aug. 17th, 1899, Mr. Hartzell, who had been appointed a committee to investigate a complaint in reference to the sewage from the Fairmount Children's Home, reported that arrangements had been made to purify the sewage of the Home, and he presented plans for purification works to be installed there and recommended that they be approved by the Board.

The plans were prepared by Mr. O. W. Pfouts, Engineer, and provided for a septic tank and coke filters.

The Board voted to approve said plans and the following notice was sent to the Superintendent of the Home:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, August 28th, 1899.

Mr. M. M. Southworth, Superintendent Children's Home, Alliance, Ohio:

DEAR SIR:—The State Board of Health has considered the plans prepared by Mr. O. W. Pfouts, Engineer, for the purification of the sewage of your institution, and you are hereby notified that said plans have been examined and approved by the State Board of Health.

Yours truly,
C. O. PROBST,
Secretary.

By order of the Board.

DISAPPROVAL OF PLANS FOR ADDITIONAL SEWERAGE FOR THE CITY OF FINDLAY.

To the State Board of Health:

GENTLEMEN:—In response to a telephone message from Dr. Baker, of the Findlay Board of Health, I went there on July 5th, to confer with the local board in reference to an alleged nuisance arising from a stone quarry at the east end of Lima street, into which a sewer empties, and it is claimed the wells in the neighborhood are polluted from it, which I think is true. The local board will order the nuisance abated.

While in Findlay the city engineer, Mr. E. C. Bolton, submitted plans for the proposed sewers for East Lima and East Hardin streets.

The sewer proposed for East Lima street is to extend from Main street east on Lima street a distance of 1,900 feet to be carried across the stone quarry above mentioned, then under the T. & O. C. Ry. and empty into Eagle creek above the city, and about one-half mile from where it empties into Blanchard river. It is not proposed that this sewer will do away with the one that empties into the stone quarry.

The proposed sewer for East Hardin street is to extend from Main street east along Hardin street a distance of 1,016 feet and empty into Eagle creek about one-fourth mile above its outlet into the Blanchard river.

The proposed outlet of both these sewers is in the city and above the main portion of it so that all sewage from the proposed sewers would be carried through the main part of the city in its crude state and add to the already polluted river and extend the pollution further up the stream and also befoul Eagle creek.

Plans have been partly prepared for sanitary sewers for the entire city.

I would recommend that they be completed and when approved that all sewers be constructed to conform to the general plan.

I would recommend that the proposed sewers for East Lima and East Hardin streets be *not* approved.

Respectfully,

R. D. KAHLE,
Committee.

July 14, 1899.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, O., August 16, 1899.

To the Mayor and Council, Findlay, Ohio:

DEAR SIR:—The State Board of Health has considered plans for the building of sewers for your city, one on East Lima street to be discharged into Eagle creek about one-half mile from its juncture with

the Blanchard river, and another on East Hardin street to be discharged into Eagle creek about one-fourth mile above the juncture of said creek with the Blanchard river; said plans having been reported upon by Dr. R. D. Kahle, president of this Board.

You are hereby notified that the plans proposed for these sewers have been submitted to the State Board of Health and that the outlets therefor have been disapproved.

It is recommended that plans which have been partly prepared for sanitary sewers for the entire city be completed at an early date.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF PLANS FOR PURIFICATION OF THE SEWAGE OF THE STATE HOSPITAL FOR EPILEPTICS.

At a meeting of the State Board of Health held in Cincinnati April 20th, 1899, Mr. Bradbury representing the engineering firm of Snow and Barbour, presented plans for the Board's approval for sewage disposal works for the Ohio Hospital for Epileptics.

Accompanying the plans was the following report of the consulting engineers to the Trustees of the Hospital, which, on account of the interest involved is given in full:

BOSTON, MASS., Oct. 1, 1898.

To the Board of Trustees of the Ohio Hospital for Epileptics, E. S. Wilson Esq., President:

DEAR SIR:—In accordance with instructions received by telegraph from Dr. Rutter we have, after making the necessary surveys by sending our representative to Gallipolis, carefully considered your problem of sewage disposal, and beg leave to submit the following report.

The Ohio Hospital for Epileptics is situated on the west side of the Ohio river at an elevation of about ninety-one feet above low water datum.

The sewage at present is discharged into Mill creek, just west of the C. H. V. & T. railroad embankment. The stream about the outlet is considerably polluted, and shores more or less strewn with a deposit of filth, and the locality is offensive both to sight and smell. There is certainly need of some other means of disposal of your sewage.

On our first visit to Gallipolis it was made evident that your idea in the disposal of the sewage was to utilize the territory belonging to

Francis A. Heisner, north of the spur track from the railroad to the old mill, and an option has been obtained on this property. Appreciating the possibilities of irrigation, it was your intention to have a sewage farm and at the same time prepare a sufficient area for intermittent filtration as would efficiently dispose of the sewage at times when the conditions made disposal by irrigation infeasible or impossible. The situation is, at the first glance, apparently extremely favorable for such a system. The possibilities of utilizing the labor of the patients in the light work necessary in sewage farming makes such a system very attractive, promising considerable financial returns while at the same time effectually purifying the sewage.

To meet the varying conditions of rainfall, high river flow, and the limited needs of vegetation for moisture at different periods, intermittent filters are necessary. The lack of such provision has, in many cases, caused the failure of irrigation projects, and given an ill-deserved reputation of probable failure to a system which, if properly managed, may be made most efficient.

With the single idea of locating the filters at the Heisner property, surveys were made by our representatives on the land between the Hospital and this property, so as to locate the outfall; and of the topography at this location, so as to design the filters and farm. With this data in hand, the study of the problem was begun. The principal idea in the design, as already stated, was that the disposal of the sewage should be effected by irrigation, with sufficient area prepared for intermittent filtration as would take care of the sewage in times when the farm could not be used for such purpose. The relative necessity of these two plans of disposal must always depend on the soil of the irrigation farm. An examination of the samples of soil taken from test-pits sunk by us at various points over the Heisner property indicated its capacity for sewage disposal to be rather limited. It can, by the necessary preparation, be made capable of taking care of considerable quantity of sewage in favorable seasons, and with the fertilizing properties of the sewage valuable crops can be grown: but it is necessary to bear in mind that an irrigation farm must be managed as a farm, and with an eye single to the requirements of the crops, not as a simple means of sewage disposal. If the soil is porous and sandy the crops will take a large amount of sewage and, with benefit to themselves will satisfactorily purify it. With clayey, compact soil, such as is found at the Heisner property, the amount of sewage which can be handled will be comparatively little.

It was, therefore, necessary to accept as a primary proposition, that the principal problem in your system of disposal lay in the design of the intermittent filters. With this fact in mind, the question could not but suggest itself—why choose the Heisner farm for the location of the filters, if land equally suitable is obtainable nearer the Institution? It is generally desirable, and always economical, to arrange a gravity

outfall if this is possible. The cost of pumping and the necessary attendance adds greatly to the yearly maintenance charges, and while sometimes neglected in design, often represent an amount which will considerably more than offset items of first cost which, without due consideration, appear much more important.

A study of the amount of sewage, both present and future, proved to us that pumping would be necessary to reach filters situated above flood limits and located at a point more distant than thirty-five hundred feet from the Hospital, and it was, therefore apparent—since the soil obtainable at any site would be such as could afford only a limited means of disposal by irrigation,—that the filters, which would be the main dependence, should,— unless there were obstacles unknown to us—be placed at a location to which a gravity outfall would be possible.

The location of the filters at such a point, rather than at the Heisner property, is merely a matter of economy in design, and need have no bearing on the question of irrigation. The latter can still be carried on at the Heisner property, and when this territory is obtained and the sewage farm started, it will only be necessary to install some method of power production at the Hospital and extend the outfall pipe to this point. The economy of locating the filters at this intermediate point lies not only in the decreased first cost, but in the fact that only a small part of the total amount of your sewage can be profitably utilized in sewage farming, and it would be irrational—from an engineering standpoint—to recommend the construction of such a system that all the sewage would require pumping, when under the present plan and with no detriment to the future carrying out of the original idea the greater portion of it can flow to the filter beds by gravity. It may, perhaps, be roughly assumed that five thousand gallons per acre on alternate days would be the limit of the need of the crops for sewage and that the number of days per year in which this amount could be profitably utilized would not be more than sixty. At this rate only one-sixth of your present outflow of sewage during the year would be used in irrigation. It therefore appears reasonable to recommend such a design as will do away with the necessity of pumping the remaining five-sixths.

Having stated generally the principles and conclusions of the proposed design, the various features will now be considered in detail.

POPULATION.

The present population is, or shortly will be, one thousand patients and two hundred and fifty attendants. The ultimate future population will probably be twenty-five hundred people.

WATER CONSUMPTION.

The water consumption from April first to August twelfth, 1898, has been at the rate of one hundred and eighteen and six-tenths gallons per

capita. Our experience with other institutions of like character leads us to believe that one hundred and twenty-five gallons per capita is a safe assumption, and this amount we have used in the study of your problem. It has also been our experience that five-eighths of the total sewage flows off in eight hours. The following table is based on this assumption.

Time.	Total daily flow— 125 gallons per capita.	Flow in cubic feet per second.	
		Maximum.	Minimum.
Present	156,250	.45	.14
Future	312,500	.90	.27

The area of the beds necessary to properly dispose of the sewage is based upon the total daily flow. The size of the outfall pipe is determined by the future maximum and present minimum of sewage.

OUTFALL PIPE.

The outfall pipe is economically designed for the future, and the necessary size is determined by the maximum flow for the future, while at the same time proper provision must be made so that the present minimum flow will not be so small that a self-cleansing velocity will not be obtainable.

The head obtainable is necessarily the controlling factor in the determination of the size of pipe. The head available in the present case is the difference in height between the surface of the filters and the elevation to which it is possible to back the sewage up at the upper end of the outfall. The latter elevation we have taken to be the same as the elevation of the present junction of the laundry sewer with the main outfall sewer from the Institution. While there is doubtless a considerable rise between this elevation and the buildings it would be unadvisable to permit back-flooding of the pipes with sewage, on account of the danger of deposits forming in these pipes at the flood line. As will be explained later, the surface of the beds is to be at elevation 59. The total available head is therefore, about eleven and five-tenths feet, and it is found that an eight inch pipe could not be used as an outfall, on account of the head necessary to discharge the future maximum flow of sewage; also that while the future flow from twenty-five hundred people will give a sufficient velocity at all times through a ten inch pipe, provided the beds were not situated at a greater distance than thirty-five hundred feet from the Hospital, that the present minimum flow of sewage is too small

to produce a self-cleansing velocity in the pipe of the last mentioned diameter. While, therefore, the future maximum flow of sewage prohibits the use of an eight inch pipe, it is only necessary—in order to feasibly use a ten inch outfall—that the danger of stoppages in pipes during the present minimum flow of sewage be overcome, and this it is proposed to do by constructing a reservoir at the upper end of the outfall sewer, which will be discharged intermittently by an automatic siphon at a rate equal to the future maximum. In other words, it is proposed that the present intermittent discharge be at the same rate as the flow from the Institution will be when there are twenty-five hundred people contributing to the sewer. This rate, which will average about one cubic foot per second, is such as will at all times give a velocity which will be self-cleansing and will effect good distribution over the surface of the filters, while the head necessary to force this amount through the outfall will not be greater than that easily obtainable.

It is, therefore, proposed that a ten inch cast iron pipe be laid from the reservoir to the disposal field. The pipe line will pass under the highway bridge and follow along the west side of the railroad keeping near the toe of the embankment and crossing this embankment near the location of the filters. The proposed location is within the land of the railroad, but we have assumed that an arrangement can be made whereby this route will be possible. The pipe will necessarily act as an inverted siphon, the low point of which will be at the crossing of Mill creek, where the head on the pipe will be equal to about thirty-five feet. The velocity will vary from two feet per second at the commencement of siphon action to one and one-half feet per second at the close of each discharge. At the crossing of Mill creek a blow-off as shown on sheet of details, will be constructed. Through this blow-off, the entire length of ten inch pipe above water level may be emptied, and by pumping the sewage through the side manhole it will be possible to inspect the entire length of pipe. Through the manhole in the main pipe rods can be inserted if there should happen to be any lodgment of sediment, and the same can be easily removed.

In order to make possible this emptying of the pipe it is planned on a grade sloping each way to the point of blow-off. The cut necessary to obtain this will be light and the expense small. Should it be found impossible, however, to use the railroad location, it is doubtful if one blow-off can be arranged so as to empty the entire length of the outfall sewer, on account of the rise and fall of the ground west of the railroad, and probably two or more blow-offs would be necessary to accomplish this. There might be more or less objection to the blowing off of the pipe at these points, but at the point proposed, which is near the present outlet, there can be no possible reason for objections, especially in view of the fact that the necessity for blowing off the pipe will only occur at very long intervals, and in all probability never.

The action of the outfall sewer as an inverted siphon, and the possibility that you may desire to extend it to the Heisner property and by installing a pumping plant, lift the sewage at times when irrigation is possible, makes it necessary to use cast iron as the material for the pipe.

In anticipation of this possibility of pumping, the gates at the filter beds have been so arranged that the pipe to the field and through the field may serve as a portion of the force main to the irrigation farm. It is also planned to put a gate and an 8"x10" Tee in the outfall sewer just beyond the reservoir, so that by connecting the discharge pipe from the pumps with this Tee and closing the gate between the Tee and the reservoir, the outfall now proposed will be able to act as a force main for the pumping plant.

RESERVOIR.

As already stated, it is proposed in order to change the present continual flow into an intermittent discharge at a rate which will produce a self-cleansing velocity, to construct a reservoir near the present junction of the laundry branch with the main pipe from the institution. That all the available head may be utilized in producing the velocity, it is necessary to locate the reservoir as high as possible. It is also desirable that the sewage be not permitted to back up into the pipe sewers, on account of the liability of deposits therein at the flood line. The water level of the reservoir when full is accordingly placed at the elevation of the final junction of present mains.

The size of an automatically discharging reservoir used in connection with intermittent filtration, may be reasonably determined by the size of dose which it is proposed to apply to each filter. If the capacity of this reservoir is one-half the size of this dose, two discharges may be flowed on each bed without changing the gates, and when the reservoir is near the fields this is an economical capacity. Where a long line of pipe extends from the reservoir to the disposal area, however, the dribbling flow of the emptying pipe nullifies to a considerable extent the intermittent action of the siphon, and it is desirable to make the reservoir at least the capacity of one dose. If larger than this more active attendance on the diversion gates of the field is necessary. We have, therefore, planned on a reservoir of twenty-five thousand gallons capacity, the quantity which, as explained further on, it is proposed to apply to a bed at one time. An eight inch Miller Special automatic siphon will effect the discharge at the rate of one cubic foot per second.

The reservoir is forty feet long by fifteen feet wide, with an average depth of six feet. A gate chamber is to be constructed at one end, in which a screen and the gates necessary to turn the sewage either into the reservoir directly, to the beds through the ten inch pipe without entering the reservoir, or through the by-pass to the present sewer outlet, are placed. It will thus be possible to flow the sewage directly to the

beds at any time when work may have to be done in the main chamber of the reservoir; or if any accident should happen to the siphon by opening the gate governing the ten inch by-pass the sewage may be turned through the first compartment of the gate chamber into the present outfall. Also in times of high water, when the dilution will be such as will render it unnecessary to use the filter beds, the sewage will be flowed directly into Mill creek through this by-pass. Such a concentration of gates within this small space makes the maintenance of the system most convenient. It is to be noticed that the entrance pipe to the reservoir is at the same end as the outlet. We believe that by this arrangement the heavier suspended matters of the sewage will settle near the siphon, and will be washed out at the first part of each discharge.

The gate chamber is divided into two parts, in one of which the screening cage is hung, and the other is of such a size that should a pumping plant be installed in the future and compressed air be utilized in the production of the necessary power, the tanks for the operation of such a system can be placed in this chamber. An overflow is built in the dividing wall, and through it the sewage will flow to the ten inch cast iron outfall should any stoppage take place in the siphon. This overflow is placed at a slightly lower level than the by-pass to the present outlet at Mill creek, so that this latter outlet will only come into use with the stoppage of the ten inch cast iron pipe. It is therefore impossible for any accident to happen either in the reservoir or outfall sewer which will seriously affect the disposal of your sewage. The discharge of sewage for a few hours, at the point where it has been discharged for some years, will certainly not afford any ground for objection.

The walls and bottom of the reservoir are to be constructed of brick; the roof of steel I beams and four inch brick arches; the inside of all brickwork will be carefully plastered and left in such a condition that it can readily be kept clean.

Over the gate chamber a small stone gate house is to be constructed. It is to be built of sand-stone corresponding to the construction of the present buildings, and be finished up in such a way that it will be an ornament to the grounds. In this building the counter-weights for the screening cage will be hung. This screening cage is suspended in front of the influent sewer, and is arranged so that when full it can, by the action of the counter-weights, be easily raised above the floor level of the gate house and its contents, by the tripping of the bottom, quickly dumped into a tightly closed hand-cart wheeled beneath the screen. The screenings can then be taken without observation to the boiler house, where they can be burned, or to any other point of deposition. The floor of the gate house will be made of concrete and everything finished up in the best possible manner. It is proposed to

place a ventilator on the roof of the building, and to the ordinary observer it will not be apparent that this building has anything to do with the sewage system.

FILTER BEDS.

In selecting a site for the disposal field, the elevation necessary to avoid river floods was a primary consideration. Our investigations as to floods limits developed that in the spring of 1898 the water reached elevation 54.71; in 1897, elevation 55.41; and in the extreme freshet of 1884, elevation 63.77. We have, therefore, assumed elevation 56 as the height which the sewage freshet level will not exceed, and based the location of the filters on this assumption. It is realized that river floods sometimes rise to a considerably greater height, but it would not be an economical design to plan for the very infrequent extreme freshet levels. Any damage resulting at such times to the beds placed below this limit will be easily offset by the decreased cost of maintenance.

Assuming four feet as the necessary depth of filtering material, and the surface of the beds at elevation 59, the underdrains will be at elevation 55, or slightly below the elevation which the average freshet level reaches. In other words, the lower foot of the bed of the filter may be back-flooded for a depth of several inches during a few days of each year. This will not interfere with the value of the filters, because at such times the sewage can be turned directly into the stream at Mill creek, and the recession of the water will leave the filters in a condition to immediately continue the work of purification. So long as the river does not rise to a point where it can overflow the embankment of the filters, no damage will be done. The result of such flooding over the surface of the filters would be the silting of the beds by clay in suspension in the river water at this season of the year, which would necessitate scraping and the expenditure of a small amount of money. Such freshets will occur so seldom, however, that the necessary amount spent in this work will be so little as compared with the money saved by obtaining a gravity outfall, that it is not the part of economy to place the beds so high as to avoid this result. As already stated, pumping will be necessary in order to reach beds placed higher than those proposed. Leaving out the first cost of pumping, the capitalized value of the yearly cost of lifting the sewage would amount to several thousand dollars in all probability, as the duty obtained in such a small pumping apparatus is usually low. Finally, the present appropriation would not permit the installation of any such plant, if designed economically for the future.

Accepting, then, this elevation 59 as that at which the beds should be reasonably placed, the nearest obtainable territory that presents a surface at about elevation 55, provided this territory is not too near the institution or other habitation, should be chosen as a site for the disposal field. Such an area we believe is found in the triangular piece

of land owned by the Gallia county infirmary, lying east of the railroad and at a point distant about thirty-five hundred feet from the institution. Upon this land we have planned to build the intermittent filters. As we have endeavored to show, this choice of location is merely a concession to economy. If, in the future, you should obtain the Heisner property and decide to use it as an irrigation farm, it will only be necessary to extend the outfall pipe to this territory and install some system of pumping at the hospital. With this possibility in view, the present plan has been designed so that it can feasibly be used as a portion of the pumping system. If pumping is to be introduced, it is our opinion that some system of lifting by compressed air would be the best, especially in view of the fact that you already have planned to obtain your water by an air pumping system from wells. While, as already stated, the size of outfall is determined by future requirements, on account of the economy of present increase of size of pipe over future extensions, the filters may be reasonably planned only for the present. Before determining upon the area necessary to purify the sewage, the material to be used in the filters must be decided upon. In this connection we made a careful investigation of the possibilities of obtaining coke or coal in your vicinity, sending our representative to the mines in West Virginia and writing our intentions to many places not visited. We found, in spite of the greater capacity of this material, that either the price or the inability of the manufacturers to supply the necessary quantities in any reasonable time, made their use prohibitive. We have, therefore, decided to use sand. Several sand deposits are available, and the results of mechanical and chemical analyses of samples from these were given in the preliminary report already transmitted to you. Based upon these analyses and upon the extent and accessibility of the deposits, we recommend the use of the large sand bank near the railroad and southeast of the institution. We have estimated the filtering capacity of this material at seventy-five thousand gallons per acre per day, and on this assumption have planned for two acres of filters, divided into eight beds.

The site of the filters will be graded into waves or slopes which will be covered to a depth of four and one-half inches with the coarsest material obtainable to facilitate the lateral flow of the effluent to the drains, which will be laid at the bottom of the slopes and surrounded with screened gravel. Upon this foundation so prepared an average depth of three and six-tenths feet of sand will be placed, and we believe that if the sand bank has been properly represented by the sample analyzed this depth of material will effectually purify your sewage, provided the sewage be thoroughly distributed and the filters properly managed. Any lesser depth of filter would probably result in the passing of the sewage through the filter in spots too quickly to effect purification. While it is a fact that the purifying action is largely confined

to the upper layers of the bed of the filter, the remaining depth is the most economical provision that can be made to prevent too rapid filtration.

The embankments will be built to elevation 61, so that the surface of the filters will probably never be subjected to any river flood.

While the capacity of the filter is estimated at seventy-five thousand gallons per acre, we believe it to be the best policy to apply the sewage at the rate of one hundred thousand gallons per acre or twenty-five thousand gallons—the capacity of the reservoir—on one-fourth of an acre, the size of a filter. If no sewage flowed into the reservoir at the time of discharge, this dose of twenty-five thousand gallons would be applied to the beds in about one hour. In time of maximum flow of sewage, however, the inflow into the reservoir during the discharge will amount to another twenty-five thousand gallons, so that at times of maximum flow two beds will need to be used during one discharge of the reservoir. This can be done by operating two gates and allowing the sewage to flow upon two beds at one time, or by having an attendant shift the sewage from one bed to another. The routine of dosing will therefore be at present four discharges of the reservoir, two in the daytime when fifty thousand gallons will flow to the filters at each discharge, and two during the night when practically only the capacity of the reservoir will be discharged. Thus only six beds need be used in each twenty-four hours, the other two being available for raking, weeding, and any other manipulation of the surface.

The danger of applying sewage in these quantities on beds of the depth proposed, is that if not properly distributed over the surface of the filters it will pass through too quickly in spots. Distribution is, in fact, the key-note of successful management of intermittent filters; but it is recommended, in order to make their successful accomplishment of this important feature, that carriers as shown on plans be constructed.

The application of the sewage to the different beds will be controlled by gates, and to meet the peculiar conditions of your problem a special design has been made. These gates are very light, of cast iron, and while cheap will permit rapid handling and at the same time make it possible to utilize the main pipe through the filtration area as a part of the force main to the irrigation farm should pumping system be installed in the future.

The underdrains will flow to one main drain, and the effluent through this will be carried to the brook west of the railroad.

The embankments are to be covered with a six inch coating of loam, and this should either be seeded or sodded at as early a date as possible. The appearance of any filtration field depends largely upon the grading and surface finishing of the embankments; in fact the reputation for success of many sewerage plants is more often determined by surface appearance than by actual work done.

ESTIMATE OF COST.

Reservoir	\$1,150	
Gate house	350	
Sewer connection, (10 in. vitrified pipe).....	50	
Outfall pipe, (10 in. cast iron).....	3,350	
Filter beds	7,600	
		<hr/>
		\$12,500
Add 10% for contingencies.....		1,250
		<hr/>
Total		\$13,750

This estimate has been based upon our experience of other work of like character, well handled. The cost of the filter beds is figured on the assumption that the sand filling will be hauled by teams through the grounds of the hospital and the road to the county infirmary across the fields of the latter institution if possible, so as to avoid the hill, and through the old cart road to the site of the filters. We would strongly urge, however, that an effort be made by you to arrange with the railroad so that the contractor can do this work by train. After the preparation of the foundations of the filters, and the laying of the underdrains, a large number of men may be profitably put on this work, and with trains it could be done in a few days at a cost considerably less than that estimated. If you can make such an arrangement before the letting of the contract, and make it known to the bidders that this arrangement is available to them, you will doubtless obtain a proposal for this work at a very reasonable figure.

You will notice by the specifications that we have planned that the work be done in one contract; this will enable the several portions to be much more economically handled than if let in sections—the entire construction is of a convenient size and nature to be quickly handled by any competent man.

In connection with the letting of the work, we would respectfully advise that our representative be given an opportunity to explain the specifications and intentions to the contractor. We believe that by doing this considerable money can be saved, as high bids are more often the result of misunderstanding than reason.

You will also notice that we have specified that the gates, siphon and screening cage be furnished by the Trustees. This we believe to be a measure of economy, as if furnished by the contractors—who are always more or less bothered by new designs—a much higher price will have to be paid than if obtained directly from the manufacturers by you.

The work should easily be completed in less than two months; any number of men can be worked without over-crowding, and the rapidity of construction depends entirely on the necessity for speed.

The form of contract, with enclosed specifications, is that most approved in Massachusetts, but if it be contrary to the customs or laws

of Ohio the specifications proper can be easily separated and renumbered, and the general clauses of the usual form in Ohio attached.

To resume,—it is proposed that two acres of filters be constructed on the land of the county infirmary by filling with sand obtained at the large bank; that the surface of these filters be at elevation 59; that an outfall pipe of ten inch cast iron, working as an inverted siphon, be constructed; that a reservoir be constructed of twenty-five thousand gallons capacity, to be discharged intermittently by automatic siphon, at a rate equal to the future flow of sewage from twenty-five hundred people, thus insuring a self-cleansing velocity; that a connection be made from the reservoir to present outlet, as a safety provision, and that a gate house be built in which the gates may be operated and the screenings dumped, without observation, into tight carts.

We feel that this design will insure for your institution a disposal plant which will effectually purify your sewage with small cost of maintenance. The plan, in all portions in which future extensions will cost more than if made at present, has been designed for the future—it is economical in that it can be extended in the several portions should the future growth of the institution make this necessary.

IRRIGATION.

Having presented what we believe to be the best and most economical method of disposing of your sewage, within the limits of the present appropriation, we shall now take up in greater detail the question of irrigation.

Messrs. Baker & Rafter, in their well known work on sewage disposal, use these words in regard to irrigation: "Broad irrigation is specially adapted for the use of hospitals for the treatment of the harmless insane, all the authorities now agreeing that light out-door employment is the best remedy for such cases that can be applied." This statement undoubtedly applies equally to the patients treated at your institution.

Beyond its value as a means of healthful employment, however, irrigation may be made profitable where the cost of labor is low. There is not the slightest doubt but that by the use of sewage, land may be fertilized and crops far exceeding in value the average yield of the soil may be produced. The kind of crop which may be raised most profitably will depend largely on the local demand. Almost all kinds of garden truck can be raised. At Brockton, Mass., we have succeeded personally in growing turnips, cabbage, squash, tomatoes, sweet corn and yellow corn. Corn is undoubtedly the crop which, with the least amount of labor, will produce the greatest returns. Success in raising any of these vegetables depends entirely upon the proper equating of the amount of sewage to the necessities of the soil.

As already stated, the failure of irrigation projects have been caused usually by a disregard of the essential factor of success, namely, that the amount of sewage treated must depend entirely on the needs of the crop. If more sewage is applied to the land than the crops can utilize to their benefit, failure will inevitably result. When, however, in conjunction with the former there are filter beds on which the sewage can be turned at times when the crops do not need irrigation, then success may be reasonably expected. It was with this idea as a first premise that the proposed system of filter beds were designed. But while we propose this as absolutely necessary for the disposal of the sewage successfully, we strongly urge the extension of the outfall to the Heisner property, and the utilization of this territory as an irrigation farm.

If the filter beds can be constructed by arranging for the transportation of the sand filling by the railroad a considerable amount of money will be saved. It is impossible for us to estimate without a more definite knowledge of the situation what this saving will be. We strongly urge, however, that an effort be immediately made to obtain a further appropriation equal to the difference between this amount and the estimated cost of the irrigation project.

The plan of the irrigation project includes a line of 8" cast iron pipe running from the filter beds to a point in the Heisner property beyond the spur track, a line of 8" cast iron pipe from this point easterly crossing the ridge, running a distance of about one thousand feet, and two lines of 10" vitrified pipe following the east and west boundaries of the Heisner property.

The 8" outfall crosses the land of W. A. Sharon and the forty-acre lot of Heisner. It is possible to irrigate at this deviation and a suggested branch for the second of the two properties is indicated on the plan.

The outfall from filter beds and the distribution pipes are so arranged that they can be emptied through the blow-offs at the farm. These blow-offs will discharge the sewage at points where it will be purified by the intervening land before reaching the brook.

In order to make possible the emptying of the 10" pipe lines, it will be necessary to build the pipes for a portion of their length in embankments. These will not be either high or wide, and being along the boundaries of the estate will not be objectionable in any sense.

It is proposed to use 8" cast iron pipe in the line crossing the ridge, in view of the possibility for future extensions and the consequent difficulty in estimating what the pressure ultimately may be upon the pipe. The lines along the east and west sides of the farm, however, are to be of 10" vitrified pipe, on account of the greater cheapness of this material compared with cast iron; the larger size being used to reduce as much as possible the friction head. The total head against which the pumps must act when sewage is being applied from the extreme end of the

10" line will be about forty feet. The maximum pressure upon the 10" vitrified pipe will be but very little and can be safely governed by an overflow placed at the end of outfall pipe.

In designing the distribution pipes a discharge at the rate of one cubic foot per second has been assumed. It would be difficult with a lesser discharge to properly distribute the sewage over the land.

A special design of cheap cast iron hydrant, shown on plan, has been prepared to discharge the sewage from the distributing pipes. At the points where hydrants are to be placed short lengths of cast iron pipe, either Tees or quarter bends will be placed in the vitrified pipe line. This is to provide a stronger joint of the hydrant special with the main pipe.

The plan of distribution of the sewage over the ground is rather suggestive than in detail for active construction. The actual method of applying the sewage may be profitably left until construction is begun, and the crops and method of farm management determined upon. The systems of distribution generally used are three in number, namely, hydrant and hose, ridge and furrow, and the catch-work or contour system. The first is available when the necessary pressure can be obtained, and while requiring more attendance probably enables better distribution to be effected than by any other method. It was partly with the idea that such a method may be used upon the ridge that cast iron is recommended for this line of pipe. The second, or ridge and furrow system, is specially adapted to the growing of crops or garden truck on level or slight-sloping land. The third, or contour system, is principally used on steep slopes. Whatever method is to be used will depend as already stated, upon the management of the farm and can reasonably be left until a later date.

The amount of underdrainage shown upon the plan may appear excessive, but it is believed that drains forty feet apart in the material to be found upon the Heisner property are not too near together. The cost of the underdrainage system and of constructing the distribution ditches need not be considered except so far as the cost of material. This work can be easily done by the patients, and only so much of the underdrainage system constructed for the present as the area under cultivation makes necessary. While the plan shows an open ditch into which the underdrains are to flow, this would preferably be replaced by a covered drain with catch-basins at intervals for the surface water.

The entire system is designed with the idea that other land in the vicinity may be required and added to the farm in the future, and with this in view the westerly line of distributing pipe is shown on the plan as extending into the adjoining property. Should this territory not be obtained at present, it will be necessary to make a slight change in the location of this pipe.

As already stated in the first part of this report, pumping will be necessary to flow the sewage upon the Heisner property. It is difficult, at present, to decide upon the most economical plan for this purpose. Undoubtedly a system of pumping by compressed air, power to be transmitted from the present boiler house to the reservoir, would be the neatest arrangement, and if compressed air is to be used in the obtaining of your water supply and an arrangement can be made whereby the same compressor will be available for both systems, this should be the method employed for pumping the sewage.

From the data which we have been able to obtain as to your intentions regarding water supply, however, we are not able to definitely state that the same compressor can be employed. The possibility of its use for this double purpose will depend upon the amount of storage provided in your water supply system, and the ability to shut off the pumping of the water during the short time necessary to empty the reservoir. It is probable that a system more economical in first cost can be arranged by the installing of steam pumps or pumps driven by gas or oil engines. This will necessitate the construction of a larger building near the reservoir, and more immediate attendance, probably necessitating an additional man.

We would recommend that the pumping be done by compressed air and Shone Ejectors. The following is a copy of a letter from Mr. Broughton, manager of the Shone Company:

October 17th, 1898.

Messrs. Snow & Barbour, 1120 Tremont Building, Boston, Mass.

GENTLEMEN: Referring to our Mr. Broughton's interview with you on Saturday last, we beg to submit the following estimate for a Shone Plant for Asylum at Gallipolis, Ohio.

The plant to consist of

- (a) Two Shone Pneumatic Ejectors of 200 gallons capacity each, fitted with device so as to work alternately, and throw a continuous stream of 400 gallons per minute against head of 50 feet; the inlet and outlet pipes to ejectors to be finished off with flanges, to which the main inlet and discharge pipes can be connected.
- (b) One duplex crank and fly wheel Air Compressor of capacity to supply sufficient air to maintain with ejectors a continuous discharge of 400 gallons per minute against head of 50 feet. The Compressor to be arranged so as to stop and start automatically.
- (c) One Air Receiver of ample capacity to ensure steady working of Compressor and Ejectors.

We will supply the above specified plant, f. o. b. cars, Gallipolis, for the sum of twenty-nine hundred and eighty (\$2980) dollars.

We will guarantee our appliances to do the work successfully, and will replace or repair any parts that may prove defective in material or design for a period of one year from acceptance of same.

The whole apparatus can be arranged so as to work automatically provided steam is kept up in the boiler.

The Ejectors would require a circular chamber 11' 6" in diameter, with the floor 6' 6" below the bottom of the Reservoir. The size of the air pipe from Compressor to Ejectors should be 3½" in diameter, this can be of wrought iron.

If you favorably consider our proposition, we will send you detailed specifications of what we propose to supply.

Yours truly,

SHONE COMPANY,

per URBAN H. BROUGHTON,

Engineer and Manager.

The estimated cost of the irrigation project for the area indicated on plan, outside of the cost of underdrains and surface grading is as follows:

Pumping apparatus, (air pumps, compressor, and chamber for ejectors	\$4,000 00
8 in. cast iron outfall pipe,—filter beds to gate chamber,— 2100 ft. at 65 cents per ft.....	\$1,360 00
Specials	140 00
	<hr/>
Irrigation farm, 1040 ft. 8 in. cast iron pipe at 65 cents.....	1,500 00
3745 ft. 10 in. vitrified pipe at 25 cents per ft.....	676 00
15 hydrants and specials at \$30.00.....	936 25
2 blow-offs at \$30.00.....	450 00
3 gates	60 00
Embankment, 2000 yards, at 15 cents.....	60 00
	<hr/>
Total	\$7,982 25

Leaving out of consideration the cost of underdrainage and surface grading—work which can be reasonably done by the labor of the patients—an expenditure of eight thousand dollars will make eighty acres, more or less, available for irrigation. The area indicated on the plan to be used is about thirty acres, but to this might be added the land lying along the outfall pipe and the territory easterly of the ridge.

The cost of preparing the thirty acres, including the distributing pipes, the hydrants, underdrainage, and surface grading, but leaving out the cost of pumps and outfall pipe, would amount to about one hundred dollars per acre.

The amount which must necessarily be expended immediately is that for the installation of the pumps, the 8" cast iron outfall, the 8" cast iron pipe across ridge, and such portion of the 10" vitrified distributing pipes as may be considered necessary, together with the underdrainage of the area to be placed under immediate cultivation. We believe an expenditure of eight thousand dollars will be sufficient to put the work in a condition where any future extensions can profitably be made by labor of the patients, and we would respectfully urge that an additional appropriation of this amount be obtained.

If the farm is instituted, it will put off and perhaps do away with the necessity for future extensions of the filtration area. With a comparatively small expenditure at present a valuable means of profitably

utilizing the labor of the patients can be arranged. The gradual extension of the distributing pipes and underdrains by this labor will afford the exercise necessary for physical well-being, and at the same time prepare such an area as will ultimately be of great value in the disposal of your sewage.

While filter beds are a prime necessity, an irrigation farm will—under the conditions obtainable at your institution—be no less valuable, and it should be immediately constructed.

Respectfully submitted,

SNOW & BARBOUR.

The Board approved these plans and the following communication was sent to the engineers:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, May 1st, 1899.

Messrs. Snow & Barbour, Consulting Engineers, Boston, Mass.,

SIRS:—The State Board of Health has considered plans prepared by you for the purification of the sewage from the State Hospital for Epileptics at Gallipolis, and you are hereby notified that said plans have been approved.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF A STORM WATER SEWER FOR THE JOHNSON COMPANY IN THE CITY OF LORAIN.

Plans for a storm water sewer for the city of Lorain, or more definitely the Sheffield Land and Improvement Company (The Johnson Company) were submitted to the Board at its meeting held in Cincinnati, April 20th, 1899, by Mr. H. E. Riggs, engineer, of Toledo, and also the following report:

To the Members of the State Board of Health,

GENTLEMEN:—I submit herewith plans for the removal of surface water and the storm water sewerage of the Townsite of the Johnson Company, Lorain, Ohio.

Plans for the sanitary sewerage of this townsite were prepared by Waring, Chapman & Farquhar in 1888, and a portion of the system is built and is working in a satisfactory manner.

No provision was made by them for the removal of storm water and none for the drainage of cellars.

The Johnson Company Townsite occupies a tract of land on the slope of a long grade extending back to a summit near Elyria. The drainage of this entire slope, an area of about 3,000 acres, comes down through the built up section of the town.

The natural outlet of the whole district is the stream extending north from the end of Clinton street. This outlet is now occupied by the reservoir of the steel plant, thus diverting the water from its natural channel. This has been cared for in a makeshift way by the county ditch and Grove street and through one or two small streams to the west of Pearl street.

The entire district has a soil that is practically impervious; shale is found from four to six feet and the surface is a heavy clay soil, almost absolutely non-porous.

The result of the imperfect drainage and the impervious soil has been that the entire town had been flooded with water, cellars are full of water, and the conditions have been unfavorable for the construction of street improvements, etc.

The Johnson Company has therefore decided upon the construction of sewerage for storm water.

Acting in consultation with Mr. F. M. Haines, chief engineer of the Johnson Company, we have recommended,

1st. The construction of a large open ditch on 17th avenue, running from the C. L. & W. railway-east to Black river.

This ditch is designed to intercept all of the storm water coming down from the summit and slope, and will carry the drainage of about 2,000 acres. That portion of the townsite between 14th and 27th avenues is not built up. Only a small portion is allotted and the entire tract is covered with a heavy growth of second growth timber. It will be some years before this section is developed, and it is our aim to entirely eliminate the section south of 17th avenue from our sewerage system for some years to come and allow it to be treated as a separate sewer district when the development of the property will warrant the necessary expenditure.

2nd. The construction of brick storm water sewers designed to care for all storm water in the district between 10th and 17th avenues.

Our main sewer in this district is in 12th avenue, and we contemplate the construction of the sewers in the district between 10th and 14th avenues and as far east as Clinton street, this year, carrying an open ditch from Clinton street eastward to Black river and as rapidly as the property develops, building sections of the sewer.

This sewer will carry only storm water and cellar drainage, all house drainage being rigidly excluded, plans for sanitary sewerage having been previously prepared for the entire district.

Owing to present development of the steel plant property it is impossible to secure an outlet to the north.

Therefore, acting in behalf of the Johnson Company, I would respectfully request the approval of your honorable body, of plans for a purely storm water outlet for the townsite of the Johnson Company at South Lorain, said outlet to be located at the easterly end of 12th avenue, as platted.

Very respectfully submitted,

H. E. RIGGS,
Consulting Engineer.

The Board voted to approve plans for said storm water sewer, conditioned on its receiving nothing but storm water and cellar drainage, and the following communication was sent to the engineer:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, July 17th, 1899.

Mr. H. E. Riggs, C. E., Toledo, Ohio:

DEAR SIR:—The Board has considered your application for the approval of certain additions to the sewerage system for the town-site of the Johnson Company, Lorain, Ohio, to wit:

1st. A large open ditch on 17th Avenue running from the C. L. & W. Ry. east to Black river.

2nd. The construction of brick storm water sewers designed to care for all storm water in the district between 10th Avenue and 17 Avenue.

You are hereby notified that plans and outlet for said ditch and sewers have been approved, provided that only storm water and cellar drainage shall be admitted thereto.

Yours truly,
C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF PLANS FOR ADDITIONAL SEWERAGE FOR THE CITY OF LORAIN.

At a meeting of the Board, held in Cincinnati April 20th, 1899, Mr. H. E. Riggs, an Engineer of Toledo, submitted plans for an extension of the sewerage system of the city of Lorain and also the following report:

LORAIN, OHIO, April 18, 1899.

To the President and Members of the State Board of Health,

GENTLEMEN:—Acting in behalf of the city of Lorain, we submit herewith for your approval plans for a sewer system for the city. We also transmit for your information our report to the Common Council

of that city, and various statistical information bearing upon population, indebtedness, health, etc.

Our work at Lorain has been complicated somewhat by work which has been executed under plans prepared some years ago, also by the fact that the city of Lorain has more than doubled her population in the past six years and is growing rapidly now. The probable lines of growth are not as yet definite. The city limits now include several hundred acres of territory which is as yet unimproved, and which may rapidly build up.

As your members are aware there are several manufacturing plants located there, employing a large number of men, and consequently a great part of the present population of the city is of a class which can ill afford to undertake work involving a large expenditure of money to improve districts now unbuilt. In our opinion it would be poor economy to build for present needs only. These considerations have led us to recommend the separate system of sewerage, making provision in our sanitary main sewers for extensions to cover the entire district now included in the city limits. This forces us to provide for a population within the present city limits of 200,000.

The storm water in a great portion of the unsettled sections of the city can be diverted by means of open ditches and carried to outfalls outside the city, and the cost of building sewers to provide for it can thus be put off for some years or until the city is better able to incur the expense. Wherever this disposition of surface drainage is possible, it has been adopted.

The points in which your honorable body will be most interested and to which we wish to direct your particular attention are, First, the treatment of district number 1, which is now cared for by combined sewers, and Second, the outlets and provisions for final disposal.

First, district number 1, plans were prepared in 1889 by Walter P. Rice, M. Am. Soc. C. E., for sewers for this district. Mr. Rice provided for the combined system, using egg shaped brick sewers. The sewers in this district are nearly all built according to Mr. Rice's plans.

All the lateral sewers in this district have proven satisfactory but the main sewers are too small to provide for the storm water in heavy storms and cellars are annually flooded with water. This in our opinion is due partially to the assumption of too low a rate of rainfall and run-off, and the condition is made worse by the fact that a large amount of water not intended by Mr. Rice to reach the sewers has been brought there by ditches.

These sewers are well built, and with the addition of flush tanks on some of the lines, as recommended by us, will prove satisfactory as far as the dry weather flow is concerned, for some years. By making provision to put in relief sewers and cut off the storm water at several

points and carry it direct to the river, this district could be considered well cared for. We are compelled however to bring the sanitary sewage from district number five through this district.

At present there is a very small population in No. 5 and the storm water of the district can be cared for without bringing it into district No. 1.

We therefore contemplate the following treatment:

First. Temporarily we will admit the sanitary drainage of No. 5 into the main sewer of No. 1, providing for a population of five thousand in district No. 5.

Second. Ultimately we will construct a main sanitary sewer from the end of the main sewer in district No. 5, to the foot of Lake street, providing for all the sanitary sewage of district No. 5, and all the sanitary sewage of district No. 1, intercepting the latter at the points where our storm water interceptors are placed.

Third. Temporarily we will carry all sanitary sewage of districts 1 and 5, in the present main sewer of district No. 1, carrying same around our storm water interceptors, as per detail plans.

Our whole aim, as far as district No. 1 is concerned, is to utilize the work built by Mr. Rice, temporarily relieving the sewers of the storm water, and ultimately taking out of them all sanitary sewage and cutting the main sewer into four sections with four outlets for storm water.

The question of ultimate disposition of the sewage of the city of Lorain is a perplexing problem.

We would refer to the report of George W. Rafter, M. Am. Soc. C. E., on the water supply of Lorain, (Ohio State Board of Health Report, 1895, pp. 64-76), and we would endorse all said by Mr. Rafter relative to the pollution of Black river. The conditions are practically the same now, excepting that both Lorain and Elyria are growing and in time action is necessary.

We do not agree with Mr. Rafter on the location of the sewage disposal plant. Conditions have changed there. The land he recommends is in the heart of the city. The city is growing eastward rapidly and the improvement of the river makes every foot of land abutting on the river of great value.

For these reasons we deem it advisable to carry all sewage west of the river to the outfall at the foot of Broadway and there locate a pumping plant, carrying sewage through a force main to a location east of the city, and there purifying it. This is the more desirable as our district No. 3, as we have defined it, has an outlet which can be used for district No. 6. We cannot bring our sewage from district No. 6 by gravity to the river even were it desirable to do so as it would be necessary to pump from there. In our opinion, we should carry the much larger volume of sewage from the river to a point as far removed from the water works intake as possible.

We should carry the sewage from districts 3 and 6 by submerged outfall to a point five hundred to six hundred feet from the shore of the lake.

We have not recommended immediate action in regard to purification, and would respectfully urge your honorable body not to require it for the following reasons:

First. The city is at present bonded so heavily that it could not raise money to construct proper purification works.

Second. The city is growing so rapidly, and spreading over so much territory, that works which would be ample now, might be wholly insufficient in a few years.

Third. The problematical success of several sewage disposal plants in this state cause us to hesitate to recommend the construction of any makeshift or cheap plant, and we desire to have time enough to demonstrate the availability or undesirability of the various systems that are now in course of construction.

With these explanations, we would, as the representatives of the city of Lorain, respectfully ask your approval of the outfalls at the foot of Broadway, into Black river, being the same as now in use for the sewer system of the city, and at a point to the east of Chilson avenue, into Lake Erie with a submerged outlet as shown on the plans.

Very respectfully submitted,

L. A. FAUVER,
City Civil Engineer.
H. E. RIGGS,
Consulting Engineer.

The Board voted to approve the plans for changes and additions to the sewerage for the city of Lorain, and the following communication was sent to the city engineer of Lorain:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, May 1st, 1899.

Mr. L. A. Fauver, City Civil Engineer, Lorain, Ohio,

SIR:—The State Board of Health has considered the plans presented by you for changes and additions to the sewerage for the city of Lorain, to wit:

- a. To provide storm water overflows for Sewer District No. 1.
- b. To create a Sewer District No. 5, and discharge sewage from this District into the main sewer of District No. 1; it being understood that this is a temporary arrangement. All of the sewage now being discharged from District No. 1, and that to be discharged from District No. 5, is to be ultimately carried to some point favorable for sewage disposal.

c. To establish an outfall into Lake Erie for Districts Nos. 3 and 6, at a point to the east of Chilson avenue.

You are hereby notified that said plans have been approved.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board.

APPROVAL OF PLANS FOR SEWERAGE FOR THE VILLAGE OF McCONNELLSVILLE.

To the State Board of Health:

GENTLEMEN:—I am sending you to-day, under separate cover, a copy of a plan for the construction of a sewer in McConnelsville, and also a copy of the application made for the approval of such sewer. There would perhaps be some objections to permitting a large amount of sewage to be discharged into the river above the dam, though it is probable that no trouble would arise from the short sewer which they are now proposing to build. The nearest water supply in Ohio that would be affected by the sewage from McConnelsville would be that of Pomeroy, about one hundred miles away by the course of the river.

If approval of the plan is given I would suggest that a provision be attached, that an intercepting sewer should be built and all sewage carried below the dam whenever this shall be deemed necessary by this Board. It might be wise to further qualify the approval by providing that the village shall be required to purify its sewage in a manner satisfactory to this Board whenever that shall become necessary. You will therefore please vote yes or no on the following propositions:

- a. To approve the plan as submitted, and without condition.
- b. To approve the plan with the condition that an intercepting sewer shall be built whenever this Board shall require it.
- c. To approve the plan with the condition that the sewage shall be purified at such time as the Board may deem it necessary.
- d. To approve the plan with any other condition that you may deem it advisable to require.

An early vote is requested as they wish to begin work at once.

Yours truly,

C. O. PROBST,

Secretary.

September 1, 1899.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.

COLUMBUS, September 7, 1899.

To the Village Council, McConnelsville, Ohio,

SIRS:—The State Board of Health has considered your application for the approval of plans for a sewerage sytem, to wit: a sanitary sewer on Center street of the village, from Parade street to Main street and on Main street from Center street to the Muskingum river; also on Center street from Main street to the alley between Vine and Poplar streets; thence to the Muskingum river along the alley south of Center street, in both cases the outlets to be submerged below minimum low water and crest of the dam across the river opposite Lock street.

You are hereby informed that the two outlets hereinbefore mentioned have been approved by the Board subject to the conditions

a. That an intercepting sewer shall be built to carry all sewage below the dam across the river opposite Lock street, or

b. That the sewage shall be purified in a manner satisfactory to the State Board of Health as the Board may select. Such intercepting sewer or purification works to be constructed whenever it shall be deemed necessary by the State Board of Health.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board.

APPROVAL OF PLANS FOR SEWERAGE AND SEWAGE DISPOSAL FOR THE MONTGOMERY COUNTY INFIRMARY.

At the meeting of the State Board of Health held in Columbus, June 6th, 1899, Mr. Robert E. Kline, an engineer from Dayton, presented plans for the disposal of the sewage from the Montgomery County Infirmary and the following communication:

DAYTON, OHIO, June 6th, 1899.

To the Honorable State Board of Health:

GENTLEMEN:—We submit herewith the plans and specifications of a proposed system of sewage filtration for the county infirmary of Montgomery county, Ohio, and request your Honorable Body to consider the same at this meeting of your Board, with the aim of securing your immediate action on the same, if approved.

The necessity for the construction of a scheme of sewage disposal arises from the fact that there is at present a very unsatisfactory and unsanitary condition existing from the outflow of the sewage from the

Infirmary through the channel of a dry branch leading through the farms lying below the site of the Infirmary grounds. In the past claims for damages have been filed frequently.

The plans and specifications are general. The detail plans and working specifications will be substantially the same; the general plans being sufficient to indicate the method of the making of the improvement in contemplation.

The necessity of immediate action occurs from the fact that Wednesday, June 7th, is the last day of the quarterly session of the County Commissioners, during which session the annual levy for the expenditures in the various departments of county work are made.

We respectfully ask the approval by your Board of the plan if considered practicable.

By order of the County Commissioners of Montgomery County and Board of County Infirmary Directors.

ROBERT E. KLINE,
County Engineer.

The following extracts from the plans and specifications will show the character of the material of which the filter beds are to be composed.

"The material, to an average depth of six (6) inches, shall be spread uniformly on the sub-grade and covering the tile, and shall be of first class river or creek gravel screened to not less than $\frac{1}{8}$ inch in diameter.

"The body of the beds shall be filled with first class creek or river gravel in its natural condition, and to six inches below the levels and grades as shown by plan.

"The gravel shall be free from earth, clay and other refuse matter all of which shall be subjected to the inspection and approval of said Engineer or his assistant.

"The surface of the beds for a depth of 6 inches shall be constructed of good, clean, sharp sand, subject to approval and acceptance of said Engineer, the same to be maintained in that condition thereafter by the authorities in charge.

"Care shall be taken in the delivery of gravel upon the beds not to allow the same to become compact, the unloading of same to be done as said Engineer or his assistant may direct."

It was voted by the Board at this meeting to approve said plans.

APPROVAL FOR ADDITIONAL SEWERAGE FOR THE VILLAGE OF NILES.

At a meeting of the State Board of Health held in Columbus, June 6th, 1899, the Secretary presented the following communication from the Clerk of Niles, Ohio, in reference to additional sewerage for said village.

NILES, OHIO, May 22nd, 1899

Dr. C. O. Probst, Secretary State Board of Health, Columbus, Ohio,

DEAR SIR:—Replying to your letter regarding our sewer I was instructed to say to your Honorable Body that we are building a sewer on Robbin avenue for surface drainage and that all the property owners have signed an agreement not to connect any closets whatever. We are building it permanently and expect to use it for sanitary purposes when our disposal plant is put in. At present it will have an outlet into the creek but nothing will go through it that will contaminate the water. I enclose blue print of overflow at this point. The overflow is only for times of storms and will not pollute the water. The 2 ft 9 in. by 1 ft. 10 in. has been changed to 18 in. tile, so it makes it very safe.

Hoping this is satisfactory and that we will get a favorable reply, I remain

Very respectfully,

JNO. L. McDERMALL,

City Clerk.

It was voted to approve plans and outlet for said sewer upon certain conditions shown in the following communication which was sent to the City Clerk:

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY.

COLUMBUS, July 17th, 1899.

Mr. John L. McDermall, City Clerk, Niles, Ohio,

DEAR SIR:—The State Board of Health has considered your application for the approval of a storm water sewer on Robbins avenue in Niles with an outlet to Mosquito creek. The Board has voted to approve the outlet of said sewer for storm water purposes, with the provision that you furnish us with a copy of the agreement of all property owners residing on this street, as mentioned in your letter of application of May 22nd, 1899, that they will not connect any water closets or vaults with said sewer.

Yours truly,

C. O. PROBST,

Secretary.

By order of the Board.

APPROVAL OF PLANS FOR ADDITIONAL SEWERAGE PROPOSED FOR THE CITY OF PIQUA.

At a meeting of the State Board of Health held in Cincinnati on April 21st, 1899, the following communication from the engineer of the city of Piqua was presented:

PIQUA, OHIO, March 3rd, 1899.

Dr. C. O. Probst, Secretary State Board of Health, Columbus, Ohio.

DEAR SIR:—The city of Piqua hereby asks permission to construct a 48 inch concrete storm sewer to drain into the Miami river at a point about 300 yards north of the south corporation line of the city, the location of the sewer is along the north line of the plant of the American Straw Board Company, which I think you are familiar with. Length of sewer 1,000 feet, drainage area 38 acres, grade .5 per 100 feet, excavation, rock except 150 lin. feet which has been quarried for lime.

Yours respectfully,

H. E. WHITLOCK,
City Engineer.

It was voted to approve the plans and outlet for the proposed sewer, and the following letter of approval was sent to the engineer:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, May 1st, 1899.

Mr. H. E. Whitlock, City Engineer, Piqua, Ohio.

SIR:—The State Board of Health has considered your application for the approval of a storm water sewer to discharge into the Miami river at a point about 300 yards north of the south corporation line of the city, and you are hereby notified that the outlet of said sewer has been approved, provided that no connections for house drainage be permitted to be made with said sewer.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

PROPOSED SEWERAGE FOR RIPLEY.

To the State Board of Health,

GENTLEMEN:—On July 29th, at the request of the mayor and council of Ripley, I visited that place for the purpose of giving advice relative to the introduction of a sewerage system, and certain other matters connected with the betterment of the sanitary condition of the village. A joint meeting of the council and board of health was held and the question of sewers fully discussed. A plan for one main sewer to discharge into the Ohio river was submitted to this Board some time ago and its outlet approved. From the information I could obtain there

it seems to be true that this sewer would not suffice as an outlet for all necessary sewers for the village. It has not been so located as regards grades as to make it possible to drain all parts of the village to it. I urged that a competent engineer be employed to prepare plans for a complete sewerage system for the village, and that in all sewer building hereafter these plans should be strictly followed. The village has introduced water works and there is great need for a sewerage system. It is probable that some action towards the building of sewers will be taken in the near future.

Respectfully,

C. O. PROBST,
Secretary.

DISAPPROVAL OF PLANS FOR PROPOSED SEWERAGE FOR THE VILLAGE OF SOUTH BROOKLYN.

Mr. H. H. Braten, Mr. E. A. Stimpson and Mr. P. J. Fild, representing the village of South Brooklyn, and Mr. G. W. Cantrell, engineer for said village, appeared before the Board at its August meeting with reference to securing the approval of a sewer for said village, to be discharged into the Cuyahoga river; the sewer to be used for carrying off storm water and sewage.

At this meeting the Board adopted the following resolution applicable to such request:

Resolved, That the Board is not willing to approve any plan of sewage disposal which contemplates the discharge of crude sewage into Lake Erie or the Cuyahoga river at any point within ten miles of the intake of Cleveland's water supply.

APPROVAL OF ADDITIONAL SEWERAGE PROPOSED FOR THE CITY OF TOLEDO.

To the State Board of Health,

GENTLEMEN:—I enclose herewith letters, and plans from the engineer of Toledo, requesting approval of plans for sewerage for Districts 31 and 32 of that city.

I have inspected the proposed outlet for District 31. It is into Swan creek at a point where there is always running water and only a few hundred feet from a point where a large sewer is now discharging into said creek. This is the creek receiving sewage from the Hospital for Insane which caused complaint some years ago and led to the introduction of sewage purification works at that institution. There is no

question of pollution of a water supply in this case, and the nuisance which might possibly be created would not, I think, be a serious one. The district is badly in need of sanitary sewerage and no other outlet seems feasible. I would recommend that the outlet be approved as a temporary expedient to be abandoned whenever it may be deemed necessary by the State Board of Health.

District 32, I think, may be approved without question, the sewage being discharged practically into the Bay.

Please send me your vote as early as possible.

Yours truly,

C. O. PROBST,
Secretary.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.

COLUMBUS, November 14th, 1898.

Mr. W. F. Brown, City Civil Engineer, Toledo, Ohio,

DEAR SIR:—Your application for the approval of the outlets of sewer districts No. 31 and No. 32 in the city of Toledo has been considered by the State Board of Health, and you are hereby notified of the action taken by said Board:

The outlet of the main sewer of District No. 32, into the Maumee river at the foot of Jessie street, has been approved.

The outlet of the main sewer for District No. 31, into Swan creek at the foot of Hillside avenue, has also been approved, but upon the following conditions: That the outlet for said sewer District No. 31 shall be considered as temporary, and the Board hereby reserves the right to condemn said outlet and abolish it whenever it shall be shown that the discharge of sewage into Swan creek at this point is the cause of a public nuisance, detrimental to the health or comfort of the public.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF PLANS FOR THE PURIFICATION OF THE SEWAGE OF THE TRUMBULL COUNTY INFIRMARY.

To the State Board of Health,

GENTLEMEN:—Messrs. Snow & Barbour, consulting engineers, have submitted plans and specifications for a sewage purification plant at the Trumbull county infirmary. If you will refer to the report on investigation of rivers you will see that the sewage from this infirmary

is a menace to the drinking water of the city of Warren. The board of health of the city of Warren, its attention having been called to the matter, has brought suit against the county commissioners to compel them to enforce proper measures to prevent the pollution of the city's water supply, hence these proposed plans for sewage purification.

There is one point to which I beg to call attention. On page 6 of the Engineer's report, reference is made to an overflow from a reservoir to the crest through the old 9 inch sewer. This provision is made to prevent damming back of the sewage in case some one interferes with pumping from the reservoir. In my judgment this overflow should not be permitted. I fear there would be constant danger, at an institution of this kind, that the pumping from the reservoir would be frequently neglected, thereby permitting a discharge of crude sewage into the creek to the danger of the water supply of Warren.

On account of the suit that has been brought against the commissioners, they are very anxious that this work should begin as soon as possible and I will therefore ask you to please send me your vote as soon as may be upon approving the plans.

I wish to know whether you approve the plans, as suggested by the engineer, or whether you vote to approve the plans without the overflow spoken of above.

Yours truly,

C. O. PROBST,
Secretary.

Columbus, Ohio, March 1, 1899.

REPORT OF THE ENGINEERS.

BOSTON, MASS., Feb. 24, 1899.

*Hon. Alexander Campbell, Chairman, Thos. H. Rose, Benjamin F. Craig,
Commissioners of Trumbull County, Ohio,*

GENTLEMEN:—In accordance with your instructions we have, after making the necessary surveys by sending our representative to Warren, carefully considered the problem of sewage disposal for the Trumbull County Infirmary, and beg leave to submit the following report.

This institution is situated on the west bank of Young's run, a small tributary of the Mahoning river, about one and one-fourth miles from its mouth. The actual elevation is about nine hundred feet above sea level but in the absence of definite bench marks or elevation points a base for levels was assumed and the relative height of all points referred to this.

The sewage at present is discharged into Young's run, and although the women's building is supplied with the Smead system of dry closets, and the water closets in the men's building are used only as slop sinks, has proved objectionable to the health officers of the city of Warren, which takes its water supply from the river about three miles below.

The present population of the institution is about one hundred and twenty. Under the law requiring the removal of insane and imbecile paupers this number will be reduced to ninety. In the prosperous condition of the county it is not considered advisable to provide for any great increase. The present water consumption is about two thousand gallons per day. By the use of water closets and improved laundry machinery this may be expected to ultimately increase to about six thousand gallons per day. By the use of water closets and improved laundry machinery this may be expected to ultimately increase to about six thousand gallons per day. This will practically all reach the sewers and forms the basis on which our design has been made.

It is not advisable to allow rain water in the system, as a violent storm of twelve minutes' duration would be sufficient to fill the reservoir, and much larger disposal works would be necessary. It is proposed to allow cistern overflows and roof water from the women's building to flow to the old drain south of the building, and that from the men's building will be intercepted and carried to the brook at slight expense.

In considering the various possible methods of purifying the sewage of the institution several factors must be considered. An efficient system, easy to handle and not likely to get out of order if properly operated, combined with low cost, and economy of maintenance, is the object of this investigation and the plant recommended is believed to fulfill these requirements as well as the conditions permit. The isolated location of the institution, by increasing the cost of materials, adds to the difficulties of the situation.

Of all methods of sewage purification intermittent filtration in its various forms and with its many accessories has been proven to give the greatest satisfaction. It may be carried on, under favorable circumstances, over large areas under cultivation without special preparation; this method is generally known as broad irrigation. A small area may be artificially prepared to perform a much more rapid purification by the construction of beds of sand, gravel, or other available material. Experience has developed the fact that coke breeze possesses many qualities calculated to make it a very desirable medium. The ability of this material to withstand the action of the weather and the large amounts of sewage that have been successfully purified by its use together with the availability of a large supply at moderate cost at this point, give it a prominent place in the consideration of your problem from the start. The lack of favorable deposits of sand in the vicinity also indicates its use.

The material being decided upon, the next question is whether it will be more economical to depend altogether upon filtration, or to install some auxiliary device to reduce the labor to be performed by the filters, and thereby their size and cost. A study of the conditions and of the prevailing prices of materials and labor, develops the fact that the use

of the septic tank will prove an economical method. This is simply a dark, air tight chamber, in which fresh sewage remains at a constant height, being drawn off at a point about half way between surface and bottom in a continuous current, and just large enough to retain the sewage a sufficient time for the anaerobic bacteria or germs of putrefaction to liquefy the suspended matters and prepare the mass for easy and rapid oxidation on the beds. This device has been proven to reduce the oxidizable organic matter 30% and the suspended solids by over 50%.

The buildings of the infirmary stand at such an elevation that the basements are only two or three feet above freshet level in the brook. The filters should be five feet deep and above danger of flooding at times of high water. It is therefore evident that pumping must be resorted to. This in turn renders a small reservoir necessary as the level of sewage in septic tank must be stationary at all times. Boiler power in plenty is available in the men's building, and in order to utilize the steam to operate the pump it is necessary to place the reservoir near this building. The wastes from the women's building must be brought to this reservoir by a new sewer.

The most available location for the beds is on the slope toward the brook south of the pig pens. It is sufficiently removed from the buildings, is inconspicuous, and easily accessible; it is also somewhat farther down the brook, lessening the danger of flooding.

A force main is of course necessary to convey the sewage from pump to beds. The various parts of the plant will now be described in detail.

SEWERS.

The sewage from the men's building will be conveyed to the tank by the present sewer. A new eight inch sewer will be built from a point about 45 feet east of the women's building to the old nine inch sewer about six feet north of the reservoir, where a manhole will be placed for purposes of inspection, cleaning and ventilation. This may be so constructed as to allow the introduction of a small screen. The grade of the eight inch sewer will be 1.66 feet per hundred and the average cut 6.2 feet. At the westerly end a lamphole will make thorough inspection and ventilation possible. At this point the six inch sewer from the slop sinks will be intercepted and a six inch branch will be extended to the southeast corner of the building to intercept the present main drain at that point. This arrangement is to be considered temporary as new plumbing fixtures will probably be installed in the building and more direct connections can be made at that time. The sewer is designed for such change, and the only alteration required will be in the six inch branch. A good velocity will be maintained in this sewer, which with complete circulation of air should keep it clear and in a sanitary condition. All sewers should, however, be arranged for periodical inspection.

tion, as large foreign matters are likely to find lodgment therein, and by forming dams to cause accumulations of filth, and consequent unhealthful conditions.

RESERVOIR AND SEPTIC TANK.

The reservoir and septic tank will be built in the form of a brick chamber with a partition wall dividing it longitudinally. The westerly division will form the septic tank and the easterly one the reservoir.

These must be located, as previously stated, near the men's building, on account of utilizing steam from the boilers. The elevation is fixed by that of the nine inch sewer, which enters at the top of the septic tank and is turned down to reduce velocity and form a trap, with the double object of excluding air from the tank, and tank gases from the sewer. It is desirable to have the top of the tank near the ground surface. The only location answering these requirements is on the sloping ground south of the drive, just west of the bridge.

The reservoir is to be of brick, with brick arches sprung across each tank abutting against 5x5 steel angles, 12.3 pounds per foot, which will be held together by four lines of 3/4" tie rods. The arch will be 4" brick, with a rise of 6", and over the weir the arches will abut against a 5x4 Tee, fifteen pounds per foot, which will span the opening of three feet. The bottom of this Tee and of the tie rods must be covered with metal lathing and cement. The walls are to be of brick 12" thick, except the end walls which, if the material is good, may be made 8" in view of the short lengths between supports. The bottom of both tanks is to be of concrete 6" thick. The roof will be leveled up with concrete, which may be made of cinders to make it light, and will have a chamber of 1 1/2".

The two compartments will be each 15' long by 5' 6" wide inside measurements. The septic tank has an average depth of 5' 4" to the point of overflow into the other chamber. It is to be made 5' deep at one end and 5'-8" at the other. The springing line of the roof arches is to be one foot above high water mark. The septic tank must be completely dark and perfectly air tight; for this reason the overflow between the two tanks must be trapped. This will be accomplished by a partition extending from the roof to a point 2'-6" below high water mark, supported by brackets built out on the brick work and bolted through the roof and middle wall. For this sheet iron may be used. The overflow, which is 3' wide, is stepped down, so that the sewage will be aerated in flowing into the reservoir; thin roofing slate will project over the bricks so as to make a clean flow. In the roof of the septic chamber, a 2' circular opening is to be built, with a wooden cover, which will be so arranged as to be air tight, but may be blown up in case of the formation of any gas in the septic tank. This tank has a capacity of about three thousand gallons, and the length of time during which the sewage

will be exposed to the septic action will vary according to the amount of sewage, being in the extreme future perhaps twelve hours.

The reservoir will have an average depth of 6'-4" from high water line to bottom, and hold approximately four thousand gallons. When this capacity becomes insufficient to permit the running of the plant with one pumping per day, more pumping will have to be done or additional capacity provided; for the present this is as large as it is considered economical to construct.

The overflow will be run into the old nine inch sewer and will be fitted with a flap valve to prevent back flooding from the stream in time of freshet. An air inlet will be provided entering the reservoir close to the weir, so that the sewage will be aerated to as great an extent as possible. From either end of the reservoir a ventilating pipe will lead to the chimney of the boiler plant. This arrangement of aerating the sewage at this point and carrying off the liberated gases, is a preparation for the subsequent treatment of coke, the danger in septic sewage treatment being that these gases may have the effect of killing the aerobic bacteria if not gotten rid of, thereby greatly reducing the oxidation in the filter. A 12" sluice gate is to be placed in the lower end of the septic chamber, with a rod running up through the trap making it possible to open this from the pump house, which will permit the emptying of the septic tank into the second chamber rapidly. This is only to be used in emergency, as sewage is to remain at the same level in the septic tank at all times. Over the reservoir a small pump house, about 10' square, of wood and cheaply built, is to be placed, and the pump is to be set directly over the pump well.

The suction pipe will enter the reservoir through an opening of two feet, which is to be built in the roof and covered with a wooden cover. The pump which we recommend is the No. 2, class A, of the centrifugal type, built by the Lawrence Machine Co., of Lawrence, Mass. It is directly connected to a 4x4 vertical engine on same bed plates; two inch discharge and 2½" suction opening. This machine is compact, durable and effective; will require no expert attendance and is especially adapted for lifting sewage. Its nominal discharge is 60 gallons per minute, which will empty the reservoir in about one hour. The pump will have no foot valve, but will be primed up by an ejector which is furnished by the manufacturers. A concrete foundation will be placed under the engine extending below frost.

FORCE MAIN.

The force main will be a three inch wrought iron pipe connected with couplings. It will be so located that it will have a continuous upgrade from reservoir to beds, making it possible to empty the main, and preventing the dribbling flow of the emptying pipe on the beds.

FILTER BEDS.

The location of the filter beds is to be on the sloping ground south of the pig pens. They will be constructed of coke breeze, partially in excavation made in the natural surface, and partially retained in position by embankments constructed with the excavated material. The size of the filters, of which there are two, will be 30' square. The excavation below surface will be made with vertical slides. The dividing bank between the filters will be left vertical, and the embankment around the outside will be brought up at the same time as the coke filling, and also left vertical. The finished embankment above the surface of the coke and on the outer slopes will be given a slope of $1\frac{1}{2}$ to 1. The outlet of the underdrain must, of course, be kept above high water in creek, and will be brought to the surface as soon as possible after leaving the filters. The depth of coke is to be 5' at the underdrain and 4'-6" at the toe line of the banks. The underdrain is to be a 4" pipe, and coarse coke is to cover the bottom of the filter 6" deep at the drain and reduce to nothing at the outside. The force main will be kept down through the middle dividing wall, below danger of frost, and brought nearer the surface at the middle point of the filter beds, where it will discharge one foot above the surface of the filter. Gate boxes will be placed here, so that two 2" gates can be easily gotten at. The distribution of the sewage will be made by carrying 2" pipes across the middle of each bed, resting on brick piers 8" square. Underneath this pipe a strip of concrete 8" deep and 2'-6" wide will be laid on carefully tamped coke. Small brick abutments will be built at the points where these pipes leave the bank.

The 2" pipe is to be slotted with three lines of slots $\frac{1}{8}$ inch wide. These slots will be made by running the pipe through a milling machine and cutting a length of 18", then leaving 3" uncut, and so on; one of the slots is to be at the bottom of the pipe, and the other two $\frac{3}{4}$ " on each side of it. The slots will break joints so as to keep the pipe as strong as possible. The further end of the pipe will be covered with a cap, so that if any clogging takes place the sewage can be discharged through the other end and the pipe flushed out. The last pier will be but a short distance away from the bank and the concrete will extend beyond it. The streams which will escape through these slots will strike on the concrete underneath and serve to spray and aerate the sewage, preparing it for the future action of the aerobic bacteria.

LABOR AND MATERIALS.

Much of the labor, including all the excavation, laying sewer pipe, and most of the hauling, can be done by inmates of the institution and this has been counted on as the probable method of construction. Much time could be gained by contracting for the entire work, and this method

would be preferable to us, but since labor is available at the infirmary it will probably be utilized in the interests of economy.

The sewer pipe used will be No. 1 vitrified shale pipe of standard dimensions, in 3' lengths if obtainable. The joints will be made with neat Portland cement, of a quality equal to the best Sandusky.

All brick will be vitrified or hard burned so as to be impervious to water and will be laid in Portland cement with proper admixture of sand. Concrete will be of clean screened gravel, sharp sand, and good quality Portland or American cement, according to conditions developed in excavation.

Suitable coke for the filters may be obtained in large quantities from the Cherry Valley Iron Works, of Leetonia, and our estimates are based on figures submitted by them. It is waste material to them and they will furnish it for the cost of getting it on the cars.

ESTIMATE OF COST.

Sewer	\$52 00
Reservoir, septic tank, pump and piping.....	512 00
Force main	87 00
Filter beds	410 00
10% for contingencies.....	106 10
Total estimated cost.....	\$1,167 10

This estimate is based on the assumption that the labor of inmates will be utilized as much as possible, and does not include engineering expenses.

This plant is so designed that any part can be easily enlarged in the event of an unlooked for increase in the size of the infirmary. The septic tank is especially arranged so that in case its operation should prove unsuitable for the sewage of this institution it can be made part of the reservoir at nominal expense.

It is confidently expected, however, that the system as designed will prove effective, and add a pleasing feature to this well managed institution.

OTHER SANITARY FEATURES.

Much can be done at slight expense to improve the sanitary condition of the slaughter house, barn-yard and pig-yard, which were found objectionable in the recent report of the State Board of Health on pollution of the streams.

The soil under the slaughter house is gravelly, and if levelled up to prevent the wastes from running over the surface to the brook, will act as a natural filter and abolish the objectionable feature of the present arrangement. If it should prove to act too slowly, a line of 4" tile drain at a depth of 3' would probably remedy the difficulty.

The barn-yard may be levelled up in a similar manner and under-drained. The area devoted to pigs cannot be so treated and we recommend that a new section be used for this purpose, on higher ground, drained as suggested for the barn-yard.

By carrying out the recommendations of this report you will place your infirmary in the front rank among the institutions of the State, or in fact of any state, in sanitary condition, and remove all the objections now made to its pollution of the waters of Young's run and Mahoning river.

Respectfully submitted,
SNOW & BARBOUR.

The Board voted to approve the plans, and the following communication was sent to the engineers:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, March 7th, 1899.

Messrs. Snow & Barbour, Consulting Engineers, Boston, Mass.,

DEAR SIRs:—The State Board of Health has considered the plans and specifications submitted by you for the purification of the sewage of the infirmary of Trumbull County, Ohio.

You are hereby notified that said plans have been approved subject to the condition that no overflow from the sewage reservoir to the creek shall be permitted.

Respectfully,

C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF PLANS FOR A SEWERAGE SYSTEM FOR THE CITY OF WELLSVILLE

Plans for a sewerage system for the city of Wellsville, Ohio, were submitted to the Board by Messrs. Riggs and Sherman, Designing Engineers of Toledo, and the following explanation in reference to the construction of said sewers:

TOLEDO, OHIO, April 17, 1899.

To the State Board of Health,

GENTLEMEN:—We submit herewith plans for the system of sewerage for the city of Wellsville, Columbiana county.

Wellsville has a population approximating 8,000. The city is located on the Ohio river about four and one-half miles below East Liverpool and about twelve miles above Toronto, the two nearest towns to draw a water supply from the Ohio river.

The topography is peculiar in that the stream known as Atens run which enters the city at the end of 15th street, runs nearly parallel with the river, and in the opposite direction to Second street where it turns and enters the river. McQueens run enters the city south of Atens run, crosses 18th street near Commerce and runs parallel with the river and down stream to a point opposite 23rd street; thence Main street which is only one block from the river, is the highest street in town.

Topographically, Wellsville is divided into two main sewer districts. After full consideration of the merits of both the combined and separate systems, we reached the conclusion that the separate system was the proper one to adopt.

1st. Because of less cost of the complete system.

2nd. Because of the possibility of using Atens run for storm water disposal without sewerage the entire run at present.

3rd. Because of the better sanitary results to be obtained with the separate system on the grades which we can secure.

4th. Because of the greater ease with which sewage disposal can be provided and the less cost of pumping the sewage when disposal works are established. We therefore submit for the approval of your honorable body the map, plans, and report to the council as prepared by us. These plans embody the following points:

First. A strict separation of storm water and sanitary sewage.

Second. A division of the city into two sewer districts treating storm water and sanitary sewage in each district.

Third. Outlet sewers for first district down Second street to the river bank, thence angling down stream, securing a submerged outlet five hundred feet below First street. This outlet, owing to the peculiar conformation, is upstream from the city or opposite the up river end of the business section of town. The water works intake is at First street and will be five hundred feet up stream from the outlet. We have made a careful examination of the currents and find no eddy or up current and no one has ever made note of such a current. There are no docks or wharves to interfere with the free flow of the water, and we propose to carry our outlet to extreme low water mark, which will bring us about one hundred and fifty feet from the shore. We considered other outlets, but decided on this one because it did not involve any heavy cutting or expensive work, and further because it enables us to connect with the Wellsville Plate and Sheet Iron Works and with the dwellings in that company's addition and in the Mary A. Wells addition, all of which are provided with private sewers discharging into Little Yellow creek, above the water works.

Fourth. Outlet sewer for second district in Twentieth street, B. S. H. & M. addition. Here we make a heavy cut and carry both sanitary and storm sewers in the same street, this is done to save excessive length of storm water main and to remove McQueens run as quickly as possible.

This outlet is below the residence section of the city and there are no houses on the bank below it. We would here extend sewer to below low water, making submerged outlet.

Fifth. Owing to the fact that when the water in the Ohio river rises to an extreme stage, a great part of the city is inundated, we have been compelled to lay grades that will bring all sewers but a few laterals lower than extreme high water mark.

To overcome as far as possible the ill effects of water backing into the sewers, and remaining for a long period, we have made, and submit herewith, plans for a special flushing inlet taking a large supply of water from Little Yellow creek, controlling this supply by a valve, and we will thereby not only secure an ample flushing stream, but will be enabled to maintain a strong current in our main sewer in time of high water and very largely overcome the danger of deposit in our sewers.

Sixth. We are enabled to take a supply of water from Atens run and McQueens run to supply large flush tanks on our trunk sewers.

Seventh. When sewage disposal becomes necessary, it will be absolutely necessary to pump from both outlets and we would, in light of present development, suggest as a proper site for disposal works the unoccupied district between the Twentieth street outlet and the present outlet of McQueens run, as a suitable site. The ground here is so high that it is not submerged by any but exceptional floods and only once in four or five years need we fear a sufficient stage of water to interfere with the working of a plant.

With the foregoing, in addition to the data submitted, we would respectfully request your approval of the plans, and would request that the matter of sewage disposal be deferred until such time as all of the towns along the Ohio act in unison.

At present sewage disposal in Wellsville would probably prevent any action on sewerage as the money we have available only amounts to \$75,000 and this amount is sufficient to put in the sanitary system and a small part of the storm water system. It therefore appears to us that best results may be secured by the permission to build the sewers, which are greatly needed, and secure the proper working of the system and then, if action is necessary to prevent the pollution of the river, to require the construction of disposal works.

Respectfully submitted,

RIGGS AND SHERMAN,

Designing Engineers.

The Board having voted to approve the proposed sewerage system for Wellsville, the following communication was sent to the Designing Engineers:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, May 1st 1899.

Messrs Riggs and Sherman, Designing Engineers, Toledo, Ohio,

SIRS:—The State Board of Health has considered plans presented by you for a sewerage system for the city of Wellsville, to wit:

Separate and storm water sewers for Districts Nos. 1 and 2, the outlet sewer for District No. 1 to be at a point about 500 feet below First street, and the outlet sewer for District No. 2 to be at Twentieth street of said city.

You are hereby notified that said plans have been approved by the Board subject to the condition that the sewage from the city of Wellsville shall be purified in a manner satisfactory to the State Board of Health whenever such purification shall be deemed necessary by said Board.

Yours truly,

C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF PLANS FOR ADDITIONAL SEWERAGE PRO-
POSED FOR THE CITY OF YOUNGSTOWN. DIS-
APPROVAL OF PLANS FOR MARKET STREET
SEWER OF YOUNGSTOWN.

At a meeting of the Board held in Cincinnati, April 20th, 1899, Mr. Lillie, City Engineer of Youngstown, presented plans for storm water relief sewers for that city, and also presented plans of what is known as the Market street sewer of that city, a sewer which had already been constructed and which had not been approved by the State Board of Health.

The action taken by the Board is shown by the following letter, sent to the Engineer, by order of the Board.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, May 1st, 1899.

Mr. F. M. Lillie, City Engineer, Youngstown, Ohio,

SIR:—The State Board of Health has considered plans presented by you for a storm water sewer in Spring street, in the city of Youngstown, Ohio, said sewer to receive in time of storms sewage from the overflows of Elm street and from Bryson and Wick avenues, and you are hereby notified that said plans have been approved.

The Board also considered the plans for Sewer District No. 11, for the city of Youngstown, as prepared by you. The outlet of said sewer was disapproved.

Yours Truly,

C. O. PROBST,
Secretary.

By order of the Board.

APPROVAL OF ADDITIONAL SEWERAGE PROPOSED FOR THE CITY OF ZANESVILLE.

At a meeting of the State Board of Health held in Columbus, June 8th, 1899, Dr. J. C. Crossland, who had been appointed a committee to investigate the plans for additional sewerage proposed for the city of Zanesville, presented the following communication:

ZANESVILLE, OHIO, June 6th 1899.

To the Honorable State Board of Health, of the State of Ohio,

GENTLEMEN:—Through our local member of your honorable body, Dr. J. C. Crossland, application is hereby made for a permit to construct a sanitary sewer, throughout the length of Jefferson street in the 9th Ward of the city of Zanesville, Ohio.

The said sewer to be constructed of 24 inch tile pipe and is to be provided with four manholes, not more than 12 catch basins and about 30 house connections. The sewer is to be laid at an average depth of about 9 feet below the ground of the roadway surface of Jefferson street, and is to empty just below Jefferson street landing into the Muskingum at low water mark of said river.

Though it is desired that this sewer should be constructed as a sanitary sewer, its principle service will be to carry off surface water which cannot well be diverted to the Van Buren street sewer, also lying east and west and but two blocks south of this proposed sewer, or to the Adams street sewer also lying east and west and one block to the north of this sewer.

Both of the adjacent sewers herein referred to can not be made to serve the purpose of the proposed sewer.

Owing to peculiar conditions which can be explained to your satisfaction, by Dr. Crossland, the official minutiae of plant and profile data cannot be herewith submitted in time for action by your honorable body. Nevertheless it is urgently requested that the permit for the construction of the proposed Jefferson street sewer be granted by you at your earliest

convenience in that it is desired to construct the masonry bulkhead etc. for the sewer when the Muskingum river will be at low water, i. e., August, thus saving a very considerable expense as to cribbing etc.

Very respectfully yours,

CLAUDE V. MARTIN,
Acting City Civil Engineer.

P. S. In reply to the inquiry of Dr. Crossland we will state that all joints will be laid with first class cement and made true and tight, all basins provided with traps and manholes securely fitted with tight heavy casting covers.

C. V. M.

Upon motion of Dr. Crossland, it was voted to approve the plans and outlet of said sewer.

MISCELLANEOUS.

REPORT UPON AN INSPECTION OF THE SANITARY NEEDS OF ASHLAND.

At a meeting of the council of the village of Ashland held March 6, 1899, a resolution was adopted requesting the State Board of Health to send a committee to investigate and report upon the sanitary condition and needs of that place. Mr. Hartzell was appointed a committee and visited Ashland on March 28, and made the following report to the village authorities:

CANTON, OHIO, March 29, 1899.

Hon. Herman Thomas, Mayor, Ashland, Ohio,

DEAR SIR:—In compliance with the promise I made to you yesterday on leaving Ashland I take this opportunity of offering a few observations in regard to your sewer situation. The inauguration of a sewer enterprise involves several considerations. First, one of needs, especially as to when and where these are the most pressing; second, of the best technical or engineering methods to be employed, both in consideration of the collecting system, and in the ultimate disposal of the sewage after its collection and removal beyond the city limits; and third, in regard to the provision of funds; the amount of money that is needed must have reference to the estimate of the engineer or sewer commissioners. Both plan and estimate should comprise disposal work.

I may say right here that in order to have the approval of the proper authorities of Health any system of sewers devised for Ashland would necessarily have to be provided with some plan for the safe disposal of the effluent from the sewers into the stream. To support this opinion I need only to cite you to sections 6921, 6923, 6925 and 6927 of the Revised Statutes of Ohio.

As to Ashland's need for sewers it is hardly worth while to waste words. Any visitor to that town who visits the rear part of the best hotel, or what is called the best hotel in the place, will return from that visit with his eyes, nose, and respiratory organs all full of questions. Answers to the same do not sound well for the sanitary methods employed in the town of Ashland.

The function of the water works in a town,—and allow me to congratulate you upon the abundant supply and excellent quality of the water furnished to your town by the Ashland Water Works—is to supply to the people blessings of the highest importance; but the domestic and manufacturing uses to which that water is put necessarily

load it with impurities. Without sewers this water in its disposal is liable also to entail curses,—inconveniences as well as blessings. But I will not dwell upon this too obvious feature in your situation.

To obtain sewers you need unanimity. The people must go together. The visitor to Ashland cannot fail to be impressed by its air of thrift. The builders of such a town must inevitably have that intelligence, that appreciation of physical well being which would put a wisely devised sewer system among the indispensabilities.

I may remark in passing that the existence of the short sewers already in operation struck me as being somewhat in the nature of a hindrance. These sewers drain thickly settled parts of the city, taking away the wastes of the county buildings, the hotel, etc. It is probable that they have on their lines powerful influences, especially that of the county. Though they are clumsily constructed and the use of them, emptying as they do and where they do, is illegal, still these institutions have outlets, and the influences which should be on the side of the adoption of a wise sewer system are often hostile, at least passive. It is to be hoped that with some reflection, the interests that are thus supplied will go over to the side of an enlightened effort which has in view benefits for all the people instead of only a favored few. In any event the rule would have to be adopted and rigorously executed, that after sewers have been provided by the municipality the emptying of these wastes which now find their way into the small stream should be absolutely prohibited. All who prize healthy conditions of living would, it appears to me, with a little consideration cooperate together for the purpose of having a wisely constructed system of sewers.

As to the method of proceeding I beg to refer you to the sewer laws comprised in the paragraphs of the Revised Statutes from section 2366 to section 2406. It will be seen that many laws have been passed for the regulation of the sewer builders, and almost any wisely constructed system may find in one or other of these Statutes its proper justification. I will venture to suggest the outlines of what has been found after much experiment to be the fairest and therefore the most satisfactory method of proceeding, and it is one that has never failed of being heartily supported by municipalities.

This plan involves the appointment of a board of say five sewer commissioners by the mayor, and their confirmation by the council. The powers that would be given to these sewer commissioners may be ascertained by a perusal of the sections of the Statutes already referred to. The members will be appointed for five years, the term of one expiring each year and the appointment of one person being made the same year to take his place. No money would be handled by this commission. Its members must serve without compensation. Nevertheless this commission would be responsible to the people for the justice and correctness of the system in all its details. These respon-

sibilities ought to involve the appointment of men of excellent judgment and first-class business capacity. No step could be taken in the building of the sewer, or any other step involving the expenditure of money, without the approval of these commissioners. The engineer to be employed will be selected by them. The plans projected by the engineer from the highest point of the highest lateral down to the delivery of the effluent into the stream would have to have their approval. It appears to me that nothing could be more rational than the appointment of such a commission and the delivery of the entire problem over into their hands. As I have said before, this method has proved to be the best and most acceptable wherever it has been tried.

In regard to the provision of funds for the building of the main sewer, the plan adopted could only be submitted to the people after the sewer commissioners had agreed upon a plan for the work, because it would only be after such a point had been reached that an approximate estimate of the amount of money required could be made. Of course all I have said so far applies only to the construction of the main sewer. The main sewer would have to be built at the general expense of the city. In the case of Ashland the main sewer might reach through that part of the city in greatest need of present sewerage, and constitute a district. If hereafter it was deemed advisable to build a sub-main then another district could be erected in which the waters and the sewerage would be tributary to the said sub-main, and so on of future sub-mains and districts as might be required.

This main sewer is all that the city would need to concern itself about as a whole. The lateral sewers which are tributary to the main sewers can be, and ought to be, built as people need and demand, and are willing to pay for them, for these are paid for by abutting property. This plan is fair and democratic, and its adoption at any time is within the scope and powers of the commissioners and city council at any time.

From information obtained from your city engineer in regard to the situation in the city, the gravity fall to possible outlet, the favorable elevation at said outlet for purification purposes, your problem would seem to be exceedingly feasible, practicable and economical; and by entrusting the same to a board of prudent sewer commissioners it could certainly be solved to the entire satisfaction of the people of Ashland.

Respectfully submitted,

JOSIAH HARTZELL,
Committee.

OPINION OF THE ATTORNEY-GENERAL ON GARBAGE DISPOSAL.

COLUMBUS, OHIO, August 10th, 1899.

Dr. C. O. Probst, Secretary State Board of Health, Columbus, Ohio.

DEAR SIR:—This department is in receipt of a communication from you in which you desire an answer to the following questions:

1. Whether the fact that no place has been provided for the deposit of garbage by the municipality would excuse the tenant, or owner of the property, for having a nuisance upon his premises, and make it impossible for the board of health to punish him for maintaining such a nuisance.

In answer to the above, I would say that an individual is liable for the creation and maintenance of nuisances, independent of the fact as to whether the municipality has provided for the creation or organization of a board of health, and such individual is liable for depositing any unwholesome material on his own lands or on lands upon which he may reside as a tenant; this liability is independent of any action of a municipality providing any place for the deposit of garbage or unwholesome material, for while it is the duty of a municipal corporation so to provide, yet it does not establish nor does it take away the liability which the individual may incur. It has been frequently held by the courts, both of this state and elsewhere, that depositing anything upon one's own land, which emits an offensive or unwholesome smell, that floats over the lands of another, producing unreasonable annoyance, or discomfort, or that is productive of deleterious consequences, is an actionable nuisance, as decayed vegetables, dead animals or anything that produces injurious results in the manner named.

It has been held in this state by the Supreme Court, that a municipal corporation is not liable to a person aggrieved, for the failure of its board of health to act in the cases and in the manner provided by law. It will thus be seen that a board of health might refuse to act and no damage could be recovered from the city for such refusal, but although that may be, yet the individual who suffers garbage or other noxious substances to accumulate on his premises, would still be liable for the maintenance of a nuisance, and the same could be abated by a local board of health under the powers already provided by statute, and should the individual refuse to abate the same, he can be compelled by civil action to do so, and also by criminal prosecution.

Therefore, in answer to this question, I would say that because the municipality has not provided a place for the deposit of garbage, that cannot be urged as a reason why the individual should be permitted to create a nuisance upon his premises, and would serve as no excuse

therefor, and the local board of health may prosecute him for maintaining such a nuisance. Also those in the same neighborhood who are affected thereby.

2. You also inquire, whether the board of health would be authorized in enforcing an order requiring council to provide a place or some means whereat, or whereby garbage may be properly cared for; and, if this question is answered in the affirmative, what means should be taken by the board of health to enforce such an order.

In answer to the above, I would say that under the enumeration of powers vested in cities and villages by Section 1692 of the Revised Statutes of Ohio, full power is given to the municipality to prevent injury or annoyance from anything dangerous, offensive or unwholesome and to cause any nuisance to be abated. Also by subdivision 24 of the same section, villages and cities as well, have the power to establish a board of health and invest it with such powers and impose upon it such duties as may be necessary to secure the inhabitants from the evils of contagious, malignant and infectious diseases. They have certain other enumerated and express powers, as well as implied powers, to carry into effect the express powers enumerated, which in my opinion are broad enough to authorize the city or village council to provide a place or means whereat, or whereby, garbage may be properly cared for. This power has been frequently exercised in Ohio, and has not been seriously questioned. But your question suggests, when the council of the city or village, refuses to provide such a place, can the board of health enforce an order requiring the council to provide such place, or such method, as will effectually dispose of the garbage of a city or village.

This produces a question that the law has not presumed to exist. That is when a city or village council has a duty to perform, made so by the statute, and the power to perform it, that they will refuse to do or perform such duty.

In the consideration of such question as you have presented, it must be determined by the comparative powers of the city or village and the boards of health. In discussing these powers, it must be borne in mind that the council is the legislative body of the city or village, and the one that has the power to pass and create the ordinances for the government of the city or village. The board of health is a subsidiary board in comparison with the city or village council. The board of health may, by the express powers vested in it, make such orders and regulations as it may deem necessary for its own government, for the public health, the prevention and restriction of diseases, and the abatement and suppression of nuisances. All such orders and regulations have the same force and effect as is given ordinances of such city or village when regularly passed; in that respect the board of health is itself a legislative body. When it comes to the enforcement of such

order and regulation, it will be noticed that the employment of scavengers for the removal of garbage, etc., may be made by the board of health, but such contracts are subject to the approval of the council, and must be signed by the proper officers of the council. This is merely cited to show that the board of health is subordinate to the council in certain matters. If then, the council being the superior body in the matters suggested by you, and if the power to provide a place for depositing the garbage of the city or village, be vested in them, and they should refuse to do so, I do not think that it lies within the jurisdiction of the board of health of such city or village to enforce an order against the city or village to compel them to purchase a garbage crematory or a place upon which to deposit the offal of a city. This question being one in which the common council may exercise a discretion, and one for which it is necessary to appropriate money, I do not think it is such an order or regulation as is contemplated by section 2122 of the Revised Statutes of Ohio, as within the power and authority of the board of health to pass. I therefore hold that the local board of health would have no such authority as suggested in your question, and could not compel the council to act in such matter if they refused to act therein.

Respectfully submitted,

F. S. MONNETT,

Attorney General.

REPORT UPON CAR DISINFECTION BY MEANS OF FORMALDEHYD GAS.

(By Frank Warner, M. D., Member of Ohio State Board of Health.)

MR. PRESIDENT:—I had the honor to be appointed a committee of this Board to look into the question of disinfecting railroad coaches by means of formaldehyd gas.

I first had a conference with one of our chief railway officials in reference to this matter, and he stated that the railway companies would be willing to institute proper measures for disinfection and cleanliness provided the cost would not be excessive and also that the work should be done promptly, without too great detention of the cars in their service.

I submit a report of a test of formaldehyd gas, which was conducted with the assistance of the bacteriologist, Mr. Horton, on April 13th, 1899. The test was not altogether satisfactory, owing to conditions stated in the report of the bacteriologist. One point I think may be made in connection with this subject and that is, that for systematic disinfection of cars not known to be infected, it would not be necessary to employ means which laboratory experiments prove are required to destroy the most resisting

germs. There is little likelihood of such germs being found in ordinary railroad coaches.

Following is the report of the bacteriologist:

REPORT OF THE BACTERIOLOGIST.

On April 13th a test was made at yard "D" of the Pennsylvania Co. at Columbus. Messrs. Thiele and Burroughs represented the company. Dr. Warner of the State Board was present. The regenerators were in charge of Mr. Colton of the Columbus Pharmacal Co. The machines used were two Sanitary Formaldehyd Regenerators which produce the gas from the commercial product formalin. The doors and windows were simply closed. All other openings, ventilating shafts, closet openings, etc., were closed by being stuffed with wastes.

Cultures of *Staphylococcus pyogenes aureus*, *Bacillus prodigiosus*, and *Bacillus pyocyaneus* were made on squares of car plush and some were made on glass rods by the method of Dr. Hibbert Hill. After opening the car, the cultures were collected from the various places where they had been placed, parcel racks, window sills, seats, floor, under the matting and in the closets. The cultures were washed with 1% ammonia solution to neutralize any remaining gas, then washed with sterile water, and fresh culture media inoculated from them. Control cultures were subjected to exactly the same treatment except exposure to the gas. The cultures were kept under observation for ten days.

TEST NO. I.

Weather clear and sunshiny.

Temperature, inside 24.5 degrees C. Outside 26 degrees C.

*Wind, South. Velocity 12 miles per hour.

*Relative humidity 85.

Car No. 161 P. F. W. & C. R. W., vestibuled.

Capacity, without deducting anything for space occupied by furnishings, 4055.6 cubic ft.

Amount of formalin used, 24 oz.

Time No. 1 generator 51 minutes, 9:53 to 10:44 a. m.

Time No. 2 generator 35 minutes, 10:07 to 10:42 a. m.

No. 1 generator used 16 oz. of formalin.

No. 2 generator used 8 oz. of formalin.

By the following table it will be seen that five out of thirteen cultures gave a growth. In each case all the controls grew well. After nearly five hours the car was opened and the cultures at once collected without inconvenience from the gas, which had been lessened in its effect because of the great amount of natural ventilation arising from so stiff a breeze.

* Taken from U. S. Weather Bureau.

Culture.	From.	Organism.	Location in car.	Growth.	Time.
No. 1	plush	aureus	End. seat	0	10 days
No. 6	"	"	Middle, seat	plus	4 "
No. 2	"	"	End, window sill	plus	5 "
No. 8	"	"	Seat in closet, door closed	plus	7 "
No. 9	"	pyocyaneus	Wash bowl	0	10 "
No. 10	"	"	End, seat	0	10 "
No. 12	"	"	Under matting	0	10 "
No. 3	"	prodigiosus	End, floor	0	10 "
No. 5	"	"	Middle, seat	0	10 "
No. 11	"	"	End, window	0	10 "
No. 13	"	"	Closet seat, door open	0	10 "
No. 4	rod	"	End, rack	plus	4 "
No. 7	"	"	Ledge below window	plus	6 "

TEST NO. 2.

Weather, clear and sunshiny.

Temperature, inside 26 degrees C. Outside 27.5 degrees C.

Wind, south, velocity 12 miles.

Relative humidity 85.

Car No. 211, P. C. C. & St. L.

Capacity 3508 cu. ft., no deductions made for furnishings.

Amount of formalin used, 21 oz.

Car opened after three hours.

Time No. 1 regenerator 43 minutes, 11:26 to 12:09.

And again 18 minutes, 12:32 to 12:50.

No. 2 regenerator 20 minutes, 11:16 to 11:36.

And again 25 minutes, 12:08 to 12:33.

From start to close of gas production was 1 hour and 34 minutes of which time No. 1 regenerator was *not* in operation 33 minutes, while No. 2 was idle for 49 minutes.

All controls grew well.

Culture.	From.	Organism.	Location in car.	Growth.	Time.
No. 23.....	rod	aureus	Rack, middle	0	10 days
No. 17.....	plush	"	Ledge, end	plus	4 "
No. 21.....	"	"	Window, middle	plus	4 "
No. 28.....	"	"	Under matting, middle	plus	4 "
No. 25.....	rod	"	Ledge, middle	plus	5 "
No. 14.....	plush	"	Closet seat, open door	plus	10 "
No. 15.....	"	pyocyaneus	Seat, end	0	10 "
No. 18.....	"	"	Window, end	0	10 "
No. 20.....	rod	"	Rack, end	0	10 "
No. 22.....	plush	"	Ledge, middle	0	10 "
No. 29.....	"	"	Seat half way to middle	0	10 "
No. 27.....	"	"	Seat middle, placed in a paste board box.	plus	5 "
No. 16.....	"	prodigiosus	Floor, end	0	10 "
No. 19.....	"	"	"	0	10 "
No. 24.....	"	"	Under matting, middle	0	10 "
No. 26.....	"	"	Between seat and back, "	0	10 "
No. 30.....	"	"	Half way to middle, seat.	0	10 "

From the foregoing table it will be seen that six cultures out of seventeen grew.

The stiff breeze which occurred on the day of the tests caused so much natural ventilation that no discomfort was experienced from the gas on entering and remaining in the cars when they were first opened.

The regenerators worked in a very unsatisfactory manner.

The time that the regenerators were in operation during the second test is in a very mixed condition.

While some of the organisms used were killed and all were retarded from prompt development, yet the experiments were not satisfactory from the scientific side.

E. G. HORTON.

Bacteriologist.

REPORT UPON AN INVESTIGATION OF A NUISANCE AT CARTHAGE.

To the State Board of Health:

GENTLEMEN:—Having been appointed to investigate a nuisance at Carthage, Ohio, caused by an obstructed sewer, I would respectfully present the following report of investigations made by me on February 28th and March 2nd, 1899.

The sewer is the one completed in 1886 for the joint use of the Hamilton County Infirmary and Longview Asylum. It is a twelve-inch sewer pipe from each of the above named institutions to the point of junction at the canal in front of the Longview Asylum, thence to Mill creek, a distance of about one-quarter of a mile, it is of fifteen inch pipe. It has a rapid flow for about half of the distance. For the rest of the distance the fall is but 0.25 of a foot in 100. Owing to the sewer being so nearly level for so long a distance it has on several occasions become clogged up. That is its condition at present and the sewage escaping from the man-holes above the obstruction has covered the low land between the Carthage pike and the C. H. & D. R. R. to the extent of several acres.

It is claimed by the authorities of Carthage that the obstruction is caused by rags, clothing and such articles put into the sewer by inmates of the Asylum. The Asylum authorities, on the other hand, claim that the obstruction has been caused by materials that have found their way into the sewer in the village through openings made by the village authorities to carry off surface water. None of these openings are properly protected by gratings. From either of these sources substances that might cause obstruction of a sewer having so slight a fall might find access to the sewer.

On the part of the County Commissioners, who constructed the sewer, and the Asylum authorities, it is claimed that the connections made with the sewer by the village authorities were unauthorized and

if they had not been made the obstruction would not have occurred. The Mayor and the members of the village council, whom I met on the grounds on March 2nd, claim that the connections were authorized by the County Commissioners and promised two weeks ago to furnish me with a copy of the permit, but so far they have not done so. On the other hand the Secretary of the Board of County Commissioners told me to-day that he was unable to find in the minutes of the Board any such grant.

I am therefore unable to fix the responsibility for the present overflow. The sewer has several times been obstructed and it must inevitably become so again on account of the slight grade for so long a distance—several hundred feet. The obstructions have always been removed by the Asylum authorities, and on the occasion of my first visit Asylum employes were digging a trench to drain off the sewage, after which the obstruction in the sewer can be found and removed and thus the nuisance will be temporarily abated.

To prevent a recurrence of the difficulty a new sewer should be built having greater capacity and a steeper grade. This can and should be done by following the line of Wall street to the C. H. & D. R. R., tunneling under the road and thence to Mill creek. Surveys and estimates were made for such a sewer, to be made by the joint action of the village authorities and the County Commissioners, but the matter has not been pushed because of some lack of agreement between the parties. Until this project is carried out this will undoubtedly be a frequently recurring nuisance, the responsibility for which is a legal question which I am unable to solve.

I would recommend that the council of Carthage and the County Commissioners be urged to unite in an early effort to carry out the project for a new and better sewer under such conditions as may be required of other corporations by the State Board of Health in regard to the purification of sewage discharged into Mill creek.

Respectfully submitted,

BYRON STANTON.

March 18th, 1899.

BOND ISSUE FOR SANITARY PURPOSES BY THE CITY OF HAMILTON, ITS APPROVAL BY THE STATE BOARD OF HEALTH.

To the State Board of Health:

GENTLEMEN:—At the last meeting of the Board, held November 29th, 1898, the following communication was presented from Mr. J. J. McMaken, President of the Board of Control, Hamilton, Ohio:

HAMILTON, OHIO, November 24th, 1898.

To the Members of the State Board of Health.

GENTLEMEN:—As you have been informed by your Secretary, Dr. Probst, smallpox made its appearance in our city some time last August, but its presence was not discovered until three weeks ago.

The city has been to considerable expense in its efforts to stamp out the disease, and is still under considerable expense to maintain quarantines at different houses in which the disease has made its appearance, and the vaccination of a large number of indigent persons. The city is without the necessary funds to meet these extraordinary expenses. Its streets have been in a bad condition, not having been cleaned for two or three years for lack of the necessary funds. The recent floods have in many places washed out the streets and sidewalks, and in other instances left deposits of mud and filth. Under an Act of the General Assembly, entitled "An act to issue bonds for municipal expenses and to modify and limit the operations of Sections 1123, 2685, 2700 and 2926k, passed March 20th, 1894." (O. L. Vol. 91, page 531.) The city is prohibited from issuing any bonds for any purpose whatever, or from receiving any advance of taxes, except as provided in Sec. 8, which says that in case of an epidemic, or when in the opinion of the board of health, it is deemed necessary and expedient for the public health and for the preservation of life, and when there are not sufficient funds with which to put the city in good sanitary condition, the council of any such city is authorized and empowered to issue bonds, etc. It provides, however, before any bonds are issued or authorized in this section, the board of health shall make a written request of the council stating its reason for asking the issue of bonds, and the amount necessary, which written request shall be endorsed by the State Board of Health that it is necessary and ought to be granted.

Under a subsequent act of the council, the board of health, and other boards, in said city of Hamilton, were abolished, and the Board of Control became their successors, vested with the same powers and authority that these boards heretofore possessed. To fully comply with the provisions of Sec. 8 of the above quoted act, the Board would have to make a written request upon itself, and before presenting it would have to receive your endorsement. I have taken the liberty of preparing a resolution, which has not been acted upon by the Board, and which, in my opinion, cannot be acted upon until it receives your endorsement, which I herewith submit to you and ask your endorsement that the bonds may be legally issued, if we deem it necessary, to meet the expenses already incurred, and put the city in good sanitary condition, and that the city should be authorized to issue an amount not to exceed \$5,000.

Very respectfully,

J. J. McMAKEN,

Resolved by the Board of Control, of Hamilton, Ohio: That it is deemed necessary and expedient for the public health, and the preservation of life, that the bonds of the city be issued in an amount not to exceed \$5,000, for street and sanitary purposes. The said bonds to be issued and made payable out of the sinking fund.

I was instructed to present the matter to the Attorney-General for advice. The Attorney-General is absent and will not return until after Christmas. His assistant looked up the law and found that it had been correctly stated in the foregoing communication. Hamilton is authorized to issue bonds for certain purposes by submitting the question to the vote of the people. It is authorized to issue bonds for sanitary purposes when deemed necessary by the local board of health and the State Board of Health. After consulting with the Assistant Attorney-General I sent the following communication to Mr. McMaken:

COLUMBUS, December 3rd, 1898.

Hon. J. J. McMaken, Member Board of Control, Hamilton, Ohio,

DEAR SIR:—After consulting the Attorney-General, and referring to the State Board of Health your requests of November 24th in regard to approval of bonds that it is proposed your city should issue. I have been instructed by the Board to request that some further information be furnished regarding the necessity of said issue. The State Board of Health is required to certify that "Said request is necessary and ought to be granted", and before taking any such action in this matter the Board wishes to be in possession of evidence to show that the issue of bonds in this manner should be approved.

Yours truly,

C. O. PROBST,
Secretary.

To which he replied as follows:

HAMILTON, OHIO, December 5, 1898.

Dr. C. O. Probst, Columbus, Ohio,

DEAR SIR:—In reply to yours of the 3rd inst. I can say that I thought the reasons given you in my request of November 24th sufficient to warrant you to recommend the issue of said bonds. We have been put to considerable expense in the way of extra sanitary police, vaccination, disinfecting and cleaning up houses in which there have been cases of smallpox and other contagious diseases, keeping watchmen day and night at houses quarantined, and other expenses incident to stamping out the disease. Besides that we are unable to properly remove the garbage for the lack of funds. Owing to the lack of funds we have been unable to permit the garbage men to work but three days in the week since the first day of November, and it has been fully demonstrated that we cannot remove the garbage in that number

of days. I assure you that I would not have made the request, unless myself and the Board deemed it absolutely necessary. Bills have already accumulated which we are unable to pay.

Hoping you will take speedy action and give us the relief asked for, I remain,

Yours respectfully,

J. J. McMAKEN,
Pres. Board of Control.

Subsequently Mr. McMaken telephoned me that the city was in urgent need of funds, that already the expense of quarantine on account of smallpox had amounted to over \$2,000, that the city was in bad sanitary condition because there was not available funds for the disposal of garbage. He urged that this matter be given immediate attention. In this connection I wish to refer you to the action of the Board in connection with a request to borrow money, presented to this Board March 19, 1896, which will be found published on page 152 et. seq. of the annual report of the State Board of Health for 1896.

Please instruct me at once as to endorsing the request of the Board of Control of Hamilton to issue bonds in an amount not exceeding \$5,000 for street and sanitary purposes.

Yours truly,

C. O. PROBST,
Secretary.

The majority of the members of the Board having voted to approve the issue of the bonds by the city of Hamilton in accordance with the request given above, the following letter was sent to the President of the Board of Control:

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY.
COLUMBUS, OHIO, December 17th, 1898.

Hon. J. J. McMaken, President Board of Control, Hamilton, Ohio,

DEAR SIR:—The State Board of Health has considered your application for its approval of an issue of bonds by the city of Hamilton in an amount not to exceed five thousand dollars (\$5,000) for sanitary and street purposes, such approval being required by the provisions of an act passed March 20, 1894 (O. L. Vol. 91. p. 531). In view of statements made concerning the extraordinary expenditures required for preventing the spread of smallpox, now present in Hamilton, and the urgent necessity of funds to place the city in a proper sanitary condition, the State Board of Health has voted to approve said issue of bonds, deeming it necessary that this request should be granted.

Respectfully,

C. O. PROBST,
Secretary.

By order of the Board.

REPORT UPON AN INVESTIGATION OF A NUISANCE NEAR
KENTON.

To the State Board of Health.

GENTLEMEN:—At the request of President Kahle and Secretary Probst, I visited the fertilizer plant at Kenton, Thursday, July 27, and have to report as follows:

Said plant is located perhaps one mile from the court house in a northeasterly direction. There are no residences within one-fourth of a mile of the plant. I found the building and surroundings as clean and odorless as I should suppose a place of that kind could be kept. While not altogether pleasant, yet I do not think it is injurious to health. So far as I could learn complaints had been made by a few parties that when the wind was in the right direction to carry the odor toward their homes that it was very offensive. They do not manufacture fertilizer material, but simply prepare the bodies of dead animals for this purpose by cooking them in perfectly steam tight boilers and afterwards dry and pack into barrels and ship to a fertilizer factory at Toledo. The plant is owned by Jacob Scheidamantel, but the man in attendance when I was there informed me that they dispose of about three horses per week on an average. He also stated that they had shut down now and would not be in operation again until cooler weather. I would therefore recommend that the trustees of Pleasant township, in which the plant is located, be instructed to watch the place carefully and require the owner to keep said place in as good sanitary condition as possible by the free use of lime and such other means as are available.

W. T. GEMMILL, M. D.,
Committee.

REPORT UPON AN INSPECTION OF THE POST OFFICE
BUILDING AT KENTON.

To the State Board of Health.

GENTLEMEN:—At the request of the President, Dr. Kahle, and the Secretary, I visited Kenton last Thursday, July 27th, and in company with Postmaster Clark made a careful inspection of the building in which the post office is located and the surroundings, and have to report as follows:

The building is a three-story brick, situated on the south side of West Franklin street, with an alley on the east side of the building covered by an arch.

There is a cellar under the postoffice room which has never been finished up for any use, but contains rubbish of various kinds and

boards and shingles have rotted there, apparently for years, and give out a very disagreeable odor. There are two windows in the front of this cellar, which at the top are perhaps a foot above the level of the sidewalk, and two small windows on the east side open on the alley.

Above the postoffice room is a water closet, which though not in use at the present time, has while in use been obstructed causing an overflow and this has leaked through the floor and plastering into the postoffice room and run down the walls and the stench from same is very offensive yet. The building in the rear of the postoffice building has been used for a livery stable up to within the past three or four months; it is now used as a wareroom. The ground on which this building is located is higher than the floor of the postoffice room and the drainage is of course in that direction, and especially when it rains the water stands in puddles on the floor of the postoffice and is also very offensive and unhealthy.

The windows in the front of the postoffice room do not open, but a transom over the door is the only opening for ventilation in the front and about two-thirds of the way back on the east side is a door and window opening on this alley that is covered by an arch which is the second story of the building extending over to the building on the east side of the alley, so that the postoffice room is also without proper ventilation or means of securing same. There is no question about the exceedingly unsanitary condition of the postoffice room from the causes above stated. Mr. Clark informed me that he had repeatedly requested the local board to inspect the building and surroundings and take some action in the matter, but has been unable to get any member of said board to take any notice of his requests.

In my judgment the case is one that calls for immediate relief, and I would respectfully recommend that this Board take action at once to have the local board see to it that the building is put in proper sanitary condition, or if they will not do so that this Board will give the needed relief.

Very respectfully,

W. T. GEMMILL, M. D.,

Committee.

REPORT UPON AN INVESTIGATION OF THE SANITARY CONDITION OF LAKESIDE.

To the State Board of Health,

GENTLEMEN:—On July 19th I went to Lakeside to investigate the sanitary condition of that place. The affairs of Lakeside are in the hands of a receiver, Mr. McKim, and this year no entrance fee to the grounds is being charged. While this made it impossible to determine

exactly the number in attendance, it was thought by all whom I consulted that it was considerably larger this year than last.

I made an inspection of the grounds immediately following my arrival. I found streets and alleys clean and in good condition. Proper receptacles were provided for garbage, which was being promptly removed. So far as I could learn no uncemented privy vaults were left upon the grounds, and practically all of the closets are connected with the sewers. No well water was being used except one for stock purposes, as authorized by the Board. I was impressed with the fact that Lakeside was in much better sanitary condition than I had ever seen it before.

I visited the water filters and found them running at full force. I was led to believe that they were being operated beyond their capacity for good work, and that it would be advisable to have bacteriological examinations made to determine their efficiency. I conversed with a number of the residents and also with the resident physician, Dr. Waters, in regard to the health of the people of the place. All testified that both last season and so far during the present one, there had been an unusual freedom from disease on the grounds. Dr. Waters informed me that so far as he could learn not a case of typhoid fever had occurred or originated on the grounds last year and none so far this year. No reports of any such cases have been made to me.

Mr. Horton examined ten samples of the filtered water bacteriologically and for comparison ten samples of the unfiltered lake water; and one each of the filtered and unfiltered chemically.

His reports are as follows:

LAKESIDE FILTER TEST, JULY 30-31. BACTERIOLOGICAL.

Test No.	Date.	Hour.	Source of filtered sample.	Bacteria per c. c. filtered.	Bacteria per c. c. unfiltered.	Reduction per c. c.	Per cent.
2	30th	2.30 p	tap at hotel	184	382	198	52
4	30th	5.30 p	tap near filters	41	131	90	69
5	30th	5.30 p	tap at hotel	87	131	44	35
7	30th	8.30 p	tap at drinking fountain	309	80	..	..
8	30th	8.30 p	tap at hotel	40	80	40	50
9	31st	4.30 a	tap at hotel	157	207	50	24
11	31st	8.30 a	tap near filters	21	207	186	90
12	31st	8.30 a	tap at hotel	76	207	131	63
14	31st	10.15 a	tap near filters	55	58	3	5
15	31st	10.15 a	tap at hotel	68	58	..	..

LAKESIDE FILTER TEST, JULY 31ST. CHEMICAL.

Parts per million.	Filtered water.	Unfiltered water.
Number of sample.....	601	602
Color .....	.05	.10
Turbidity	none	slight
Sediment	none	none
Odor	none	none
Oxygen required	1.70	2.54
Nitrogen as ammonia free.....	trace	trace
Nitrogen as ammonia albuminoid.....	.062	.072
Nitrogen as Nitrates.....	trace	trace
Nitrogen as Nitrites.....	none	none
Chlorine	11.0	11.2
Alkalinity	99.4	99.8
Incrusting constituents	31.4	30.2
Total solids	169.	177.
Volatile and combustible.....	56.	82.

On receipt of this report I sent the following communication to Mr. McKim, as receiver:

COLUMBUS, O., August 7th, 1899.

To the Lakeside Company, Lakeside, Ohio,

GENTLEMEN:—On July 19th I made an investigation of the sanitary condition of Lakeside. I was much pleased with the results of this investigation. The grounds were clean and in good condition. So far as I could learn no well water was being used, except for stock purposes, and all leaky privy vaults had been abandoned. The report of the resident physician and all others who were interviewed was to the effect that there was practically no sickness among visitors or those living upon the grounds, and that last season and this one, so far, have been exceptional as regards general good health.

I did not report the results of my examination to the State Board of Health, pending an examination of our bacteriologist of the results of your water filters. I was of the opinion when I examined them that they were being pushed beyond allowable limits, and the examinations of our bacteriologist, made on July 30th and 31st, show that this is the case. The lake water during these days did not contain a large number of bacteria, but the filters were successful in removing scarcely half of those contained in the lake water. Our bacteriologist reports that when he reached Lakeside, Sunday, July 30th, the filters were being run with the regulators being entirely removed. They were replaced that day, but were again removed on the following morning. The filters, when first examined by the bacteriologist, were found to be overflowing, as water was being pumped faster than it could go through the filters. This manner of operating the filters defeats the very purpose for which they were installed, and is contrary to the requirements of the State

Board of Health and to the intentions of the constructing engineer. To insure safety of the water supply at all times, your company should at once install two additional filters similar to the ones now in use; and none of the filters should ever be operated without the use of the regulator. I would ask you to bear in mind the effect of an announcement that typhoid fever had again appeared at Lakeside, and especially if it could be shown that this was due in all probability to the improper use of your filters. Had the bacteriological examination of your filters been wholly satisfactory, it was my intention to make a public statement praising Lakeside for its present excellent sanitary condition. There will probably be a meeting of our State Board of Health next week, and I should be glad to present to the Board at that time a letter from you, stating that steps have been taken to install, at the earliest possible time, additional filters which will insure that all drinking water supplied to visitors at Lakeside will be *properly* filtered.

Yours truly,

C. O. PROBST,
Secretary.

Under date of August 8th he replied as follows:

LAKESIDE, OHIO, August 8th, 1899.

Dr. C. O. Probst, Secretary State Board of Health, Columbus, Ohio,

MY DEAR SIR:—Replying to yours of the 7th I am very much pleased to have your good opinion generally of Lakeside grounds. Certainly there has been a great improvement in the last few years. The financial condition of the Lakeside Company has absolutely prevented many things, which would have been done, if the company could have done them. The demand made this year by increased attendance could scarcely be anticipated. We did, as you have seen, add an additional tank so that the filtering might proceed without interruption. I am sorry that the examination did not show the best results but with the condition all over the country I have very little fear of any report of typhoid fever originating at Lakeside.

As to the erection of additional filters this season it seems quite impossible. Our season closes on the 28th of August, leaving only twenty days, the last ten of which are given to camp meeting, at which the attendance is always much smaller than during the encampment, and can scarcely require the amount of water we can safely give them. Should I remain in my position as receiver it would certainly be a part of the plan to increase our filtering capacity next year, but tanks could scarcely be made and filters prepared before the end of this season.

Yours very truly,

C. S. McKIM,
Receiver for the Lakeside Company.

I then wrote him that the matter would be referred to the Board at its meeting to be held on the 16th instant.

As the season had practically closed when this matter was presented to the Board no action was taken.

The following table shows the cases of typhoid fever reported as having been contracted at Lakeside before the introduction of filtered water, and the absence of cases since that time:

REPORT UPON AN INVESTIGATION OF A NUISANCE
AT LEBANON.

To the State Board of Health:

GENTLEMEN:—The communication of Mr. J. M. Johnson, of Lebanon, in reference to nuisances in and near that town, one caused by the discharge of sewage from the Warren County Orphan Asylum and Children's Home into a branch of Turtle creek, about one mile below the town, and another caused by the discharge of washings from French Brothers Creamery into the north branch of Turtle creek, having been referred to me by the President, I would present the following report of an investigation made August 11, 1899.

The sewer which carries the entire sewage from the Orphan Asylum and Children's Home, which at present contains twenty-five persons, discharges into a small branch of Turtle creek and as the pipe was not carried quite to the water level of the stream a small pool was washed out at the terminus of the sewer in which the sewage collected, giving rise to some odor, but a ditch having been dug to the stream, there is no longer any obstruction to the flow and no nuisance results. Should the trouble recur, I would advise the extension of the sewer to low water mark. The sewer was constructed about ten years ago and carries so small an amount of sewage that I think it not likely to occasion any nuisance if no accumulation is permitted to take place. I think this nuisance may be regarded as satisfactorily abated and why it should have been made a cause of complaint to the State Board, I cannot understand.

In regard to the nuisance caused by the creamery I would say that French Brothers, who handle a large amount of milk and make a great deal of butter daily, have connected a sewer from their creamery with a sewer built by the school board to drain the basement of the school house and carry off the water from a spring on the school house lot. The discharge from the creamery consists mainly of water used to wash churns, utensils and floor, and necessarily contains some milk and butter, a small amount, however, of the latter as the effluent is carefully screened. It also contains some soda used in cleaning the utensils. The discharge takes place in the town just above Mr. Johnson's pasture and is of such a character as to render the water unfit for stock and, I am told, gives rise in low stages of the stream to an offensive odor. A heavy rain having occurred a few hours before my inspection, the stream had been flushed and my information as to its condition in times of low water and warm weather was obtained from those living along the stream and from some other persons living in the town. I think there can be no doubt that the odor is, at times, very unpleasant and that the water at low stages must be wholly unfit for stock, and the nuisance is undoubtedly one demanding the attention of the health authorities.

That they have so regarded it, is shown by the action of the local board of health at their meetings held June 22nd and 23rd, at the last of which a resolution was adopted declaring that the sewage from the creamery was "in a condition dangerous to health" and "a public nuisance" and ordering it abated within forty-eight hours.

At a meeting of the Lebanon board of health called on the 26th of June at the request of the attorney for French Brothers, after hearing his statements, a committee of four was appointed to visit the creamery and report at a subsequent meeting. Since that date there should have been held one stated meeting of the board but, no quorum being present, no action could be taken. Whether the committee had made the investigation or formulated a report, I am unable to state.

The accompanying transcript of the proceedings of the meetings above referred to show that the local board now has the matter in hand. The mayor, Mr. F. M. Hamilton, states that no quorum was present at the time of the only regular stated meeting since the action above referred to was taken, and it seems to me there has, as yet, been no dereliction on the part of the local board that would justify the State Board in taking any action in the matter. I think this appeal to the State Board by one citizen is premature. A single failure on the part of the local board to get a quorum is not, in my opinion, sufficient evidence of unwillingness or inability to do its duty, and I would advise that for the present the matter be left in the hands of the local board, the State Board promising its assistance should it be unable to properly guard the sanitary interests of the community.

In this connection I think it my duty to call attention to one matter. I was told that the sewer from the school house basement with which French Brothers sewer connects, is untrapped and offensive odors from the decomposing organic matter in the washings find their way to the basement of the school house. I would suggest that the attention of the school board be called to this rumor so that, if such condition does exist, it may be remedied.

Respectfully submitted,

BYRON STANTON,
Committee.

RECOMMENDATIONS OF THE STATE BOARD OF HEALTH
FOR A SANITARY EXHIBIT AT THE OHIO CEN-
TENNIAL AND NORTHWEST TERRITORY
EXPOSITION.

OHIO STATE BOARD OF HEALTH,

OFFICE OF THE SECRETARY.

COLUMBUS, Dec. 4, 1899.

*Mr. George B. Christian, Chairman Committee on Sanitary Exhibits,
Toledo Exposition, Marion, Ohio.*

DEAR SIR:—Complying with your request, the State Board of Health has considered the direction, scope and probable cost of a desirable sanitary exhibit at the Ohio Centennial and Northwest Exposition, to be held at Toledo, Ohio, in 1903 and begs leave to respectfully offer the following suggestion relative thereto:

Without entering here into a discussion of the question, the Board would nevertheless express its sincere belief that far reaching benefits to the public may justly be expected from a sanitary exhibit such as is proposed.

Sanitation has so wide a field, concerning itself with most of the physical as well as moral relations of men, that the possibilities for a sanitary exhibit are almost without limit. The difficulty is rather as to the choice of subjects. It will be wise, in our judgment, to select certain essential features of sanitation and display these in a fitting manner, rather than to attempt to cover the entire ground. The guiding idea, it appears to us, should be education enforced by demonstration. The past has had its victories in sanitation, as in war and commerce, and these might fittingly be celebrated at such an Exposition; but it is our belief that attention should rather be directed to the future, and that the sanitary exhibits should teach lessons on hygiene which our people must yet learn, if they would reap the full benefits coming from the knowledge and practice of right methods of living. It is thought best that chief attention should be given to questions of public hygiene—those demanding the expenditure of public moneys. Certain phases of domestic sanitation are also recommended.

These will be considered as follows:

I. PUBLIC WATER SUPPLIES.

European visitors to this country are surprised that Americans should be content to drink what they speak of as *raw* water. It is probably true that there is not in Ohio a stream which would afford a perfectly satisfactory public water supply. With but few exceptions, and these are the minor streams, not one offers a safe supply.

The frightful, continuous loss of life and health due to the use of impure water should be brought to the attention of the people in some striking manner. They should also be shown that modern engineering has now made it possible for any community to have purified water, freed from all disease producing properties, and at a moderate cost.

We suggest, therefore, that all drinking water furnished to the Exposition grounds should be purified by filtration; and that the filter be made a part of the Sanitary Exhibit.

2. SEWAGE PURIFICATION.

This subject is closely related to water purification. It is a most pressing question with many cities in Ohio which have already converted streams into which they are pouring their sewage into pestilential, disease-breeding stretches of foul water. Furthermore, many of our cities are suffering severely in being obliged to make use of sewage polluted streams as sources of public water supplies.

The State Board of Health has nearly completed a systematic sanitary survey and examination, begun some years ago, of all Ohio streams. The data obtained might be used to show their present condition. By maps and diagrams it would be possible to show at a glance the various points along our rivers where sewage pollution has already reached dangerous proportions, and to some extent, to indicate the cities of Ohio, where, in the near future, water or sewage purification, or both, will be necessary.

In this connection we beg leave to quote extensively from a report to the State Board of Health prepared by Messrs Snow and Barbour, Consulting Engineers, on "A Proposed Exhibit of Sewage Purification at the Ohio Centennial and Northwest Territory Exposition:"

"The question of how best to dispose of the liquid wastes of communities is rapidly coming to the front in Ohio. An awakened interest and desire for actual knowledge is extended in almost every city and large town.

"A practical illustration of reliable methods of sewage purification on a scale large enough to convey an adequate idea of the construction, operation and relative efficiency of the different methods given at some common place where people interested could make comparisons and obtain proper impressions, would meet a public want and result in shaping local sanitary policies.

"It is proposed to eliminate all commercial features and to conduct the exhibit along lines calculated to assist the educational work which your Board is struggling to accomplish. In this way early in the new era of sanitary activity in Ohio will public sentiment be directed in right channels and a great object lesson be afforded that will help dispel stupid skepticism and prejudice, and render less liable costly blunders in public works of a sanitary character.

"The sewage of the World's Fair, per day, was 17.5 gallons per paid admission. We have assumed 12 gallons per capita as the probable amount at Toledo. Therefore the sanitary exhibit should be capable of purifying 300,000 gallons of sewage per day. The sewage of maximum days must overflow into the lake; that of minimum days must be supplied from some source without the grounds.

"The necessity of putting the exhibit in commission at least three months, and preferably six months, in advance of the public opening, makes it necessary that the full amount—300,000 gallons—be obtained for this period from the outside source. It is proposed that the city of Toledo be requested to install an electric pump on an outfall of the city sewer system, and to carry the sewage by a cast iron main through the Boulevard and Avenue, west to the Exposition Grounds and to the exhibit.

"It is proposed to dispose of its 300,000 gallons of sewage by the following methods, apportioned thus: Chemical Precipitation, 60,000 gallons per day; Aerobic Biolysis, 100,000 gallons per day; Anaerobic Biolysis, 100,000 gallons per day; Intermittent filtration, 30,000 gallons per day; Irrigation, a greater or less amount, depending upon the necessities of the crops.

"The effluent from the different methods of disposal will be collected in such a manner that samples can be separately obtained from each bed, and in such a way that it will be open to an easy inspection by visitors. In short, particular care will be taken to make an inspection and study of the operation of the different methods possible, and at the same time to sensually indicate to the average visitor the results obtained.

"It is suggested that a special report should be issued, preferably by the State Board of Health, and taking the results, costs of construction, etc., of the Centennial Exhibit as a basis for this public document, treating the whole subject of sewage disposal in a manner to present to municipal officers and others directly interested, information which will assist them in determining the best method of dealing with this important problem, whenever it shall come before them. To render this possible, a chemical and bacteriological laboratory is proposed as a necessary part of the exhibit.

"The sewage will be utilized as the necessities of the crops require. Tobacco, corn, turnips, cabbages, etc., will be raised in the portion devoted to garden truck, with grass land beyond the barn and a horticultural exhibit at various points along the drives, supplied with sewage from the hydrants. Sewage will also be used in sprinkling the lawn in front of the laboratory.

"The general effect of the exhibit to the visitor will be to evidence in a practical way the possibilities of the several methods of sewage disposal which are now believed by engineers to have a right to exist in their own particular field, and to educate him to a better appreciation of

what sewage really is, and to the fact that sewage disposal may cease to be regarded as something which is to be avoided because of an inevitable nuisance, but may rather be made attractive or wholly unsuggestive. And also to make evident to the thoughtful observer that if the economics of one particular city or town or locality makes impossible the use of one method, that there are other methods which are feasible, and can be installed without excessive cost.

"With this in view, in the construction and choice of materials of the several filters, an attempt will be made to indicate the possibility of utilizing local materials, or those available in Ohio, and to study during the operation of the exhibit, for the purpose of publishing the information, the respective merit of these materials.

"It is proposed that the management of the exhibit be along lines calculated to increase the attendance. There is a widespread interest in sewage purification, and doubtless many people from all over the country would be attracted to the Exposition by this feature, who would not otherwise attend.

"The topography of the proposed location will give a most attractive general effect. The trees will be saved so far as possible, and an attempt made to give the laboratory and other buildings and portions of the exhibit the effect of a fine country homestead, surrounded by drives, well-kept lawns, flower gardens, green pastures and a well-stocked barn. The area utilized is about 500 by 500 feet, or practically six acres. It is believed that the territory necessary for the exhibit can be utilized in as interesting and profitable a manner as is possible, and that there is enough in the project to commend it to the promoters of the Exposition, and that the State can make no more timely or important contribution than the funds necessary for this educational feature."

Such a lesson in sewage purification as is here contemplated would demonstrate that there is no longer an excuse for the pollution of streams by sewage. It would possibly lead to legislation along this line that would eventually result in a reclamation of all our streams.

3. LABORATORY.

That the fullest benefit may accrue from the exhibition of sewage and water purification, it will be necessary to provide a laboratory for the careful, daily study of the results, by chemical and bacteriological examinations. As suggested by the engineers, the results should form a basis for a public document on the subject of the purification of sewage and water which could be made of much value to municipal authorities seeking information of this character.

4. HYGIENE BUILDING.

It would be highly desirable to construct a building devoted exclusively to Hygiene. The laboratory and the water filter should be in the

Hygiene Building. A number of very important lessons, partly indicated further on, in the sanitary construction and arrangement of buildings, both public and private, could be taught by this building.

5. PLUMBING AND HOUSE DRAINAGE.

One room in the Hygiene Building might be devoted to demonstrating the principles of correct plumbing. These are comparatively simple, and might easily be taught, the pipes, traps, fixtures, etc., being placed in sight. The proper manner of connecting the house pipes with the yard drain might also be shown.

In this same room could be exhibited the best arrangement for public baths. Much attention is being given to the subject of public baths in large cities, and the benefits of such institutions might well be brought to the attention of our people.

6. SCHOOL HYGIENE.

A room in the Hygiene Building could be devoted to the various phases of School Hygiene. The construction and arrangement of seats; the position of windows for best lighting effects; the position of blackboards; the proper colors for walls and ceilings; methods of artificial ventilation—these and possibly other points in school hygiene could be demonstrated.

7. CONTAGIOUS DISEASE HOSPITALS.

Our people are largely unacquainted with the great advantages, both to patients and to the public, of having hospitals for receiving cases of contagious diseases. The ordinary pest house for smallpox has given an altogether erroneous idea of what the contagious hospital is. Such institutions are largely used in Europe, even in rural districts, and are coming into use in the large cities of this country. The proper arrangement and construction of such a hospital might be shown in the Hygiene Building.

In connection with the Contagious Disease Hospital it may be thought desirable to show a Public Disinfecting Station. The whole subject of modern methods of disinfection for the prevention of contagious diseases might be taught there.

8. PRODUCTION OF VACCINE VIRUS.

It would be desirable, though it may be found impracticable, to demonstrate the manner of producing bovine virus. Vaccination is losing ground in this country, largely through the active work of a small number of misguided individuals opposed to it. The people do not understand the great care and cleanliness exercised in producing the virus, and a proper demonstration of this would do much to remove unfounded objections against vaccination.

It is related in a recent work on vaccination, that in certain parts of France, when an outbreak of smallpox occurs, public vaccinators are sent there with a heifer ripe for taking vaccine virus, and that the people readily submit to vaccination on seeing how the virus is produced. They refuse vaccination when the virus is brought to them in the ordinary way.

It is possible that some large, reliable producer of vaccine would take hold of this exhibit, if it were thought desirable to request him to do so.

This feature of the exhibit we should prefer to have considered as a suggestion rather than a recommendation.

9. DAIRY SANITATION.

It would be extremely desirable to make an exhibit of dairy sanitation. It is doubtless true that the improper construction of the dairy barn is an important factor in the production of bovine tuberculosis. The improper care of milk, and its infection through carelessness and ignorance, is the cause of much sickness among milk consumers.

A model dairy barn—without the cows—could be a part of the Hygiene Building. It may be thought more desirable that this should be a part of the Agricultural exhibit.

10. MODEL KITCHEN AND COOKING SCHOOL.

This would be an appropriate part of the sanitary exhibit, to be included in the Hygiene Building. In connection with it there could be a valuable demonstration of food adulteration.

11. PRIZE ESSAY.

It is recommended that a respectable sum be offered for the best essay on some vital sanitary topic, competition to be open to the world. If this is adopted, it is suggested that the announcement of the subject be made as early as possible; that the essay be short, and that the prize essay be printed in advance for free distribution.

12. EXPLANATORY TRACTS.

It is suggested that brief pamphlets pertaining to the various phases of the sanitary exhibit, be printed for free distribution. They should briefly explain:

- (a) Water filtration and the relation of impure water to disease.
- (b) Sewage purification, and the evils of stream pollution.
- (c) The principles of good plumbing and house drainage, shown by diagrams, and the principles governing the construction of a healthy dwelling.
- (d) The proper construction of school buildings, and the care to be taken of the eyes of school children.

(e) The advantages of contagious disease hospitals, models of their construction, with cost and modern methods of disinfection, public and domestic.

(f) The production of vaccine virus ; with a summing up, in a terse, strong article, of the achievements of vaccination.

(g) The construction of a model dairy barn, and the proper care of dairy cows and milk.

(h) The arrangement and care of the kitchen, and the principles of good cooking.

13. SANITARY CONVENTIONS.

Public lectures by eminent sanitarians on topics of general interest might be arranged. Possibly some of the International, National and State Sanitary and allied associations could be induced to convene in Toledo during the Exposition.

It is not possible to give even estimates of the cost of these various features proposed as a Sanitary Exhibit. The installation of a sewage purification plant will require a considerable outlay. The Hygiene Building should be in keeping with the other exhibition buildings, and should provide ample room for the various exhibits.

We believe that, with an ample appropriation, the Sanitary Exhibit can be made one of the most attractive and interesting features of the Exposition. Considering the purposes in view, and the far reaching effects such an exhibit is sure to have, we feel that in no other direction will greater returns be had for the money expended.

In our judgment not less than one hundred thousand dollars should be provided for carrying out the suggestions contained herein.

The Board wishes to give assurance of its willingness to lend any assistance in its power in securing a suitable Sanitary Exhibit, and in making it a successful one.

I have the honor to be,

Very respectfully yours,

C. O. PROBST,
Secretary.

REPORT UPON AN INVESTIGATION OF A NUISANCE AT MANSFIELD.

The Board of Health of the city of Mansfield requested the State Board of Health to make an investigation of Rocky Fork creek, a creek receiving the sewage of Mansfield and of which complaint had been made as a public nuisance. An examination was made and the following letter and report will give the results:

COLUMBUS, OHIO, June 14, 1899.

To the Board of Health, Mansfield, Ohio,

DEAR SIRS:—At your request an investigation has been made as to the sanitary condition of Mansfield with special reference to the questions of sewage and water supply. I enclose herewith the report of the engineer of his investigation at Mansfield, and the report of the chemist and bacteriologist upon his examination of samples of water taken from Rocky Fork creek above and below your city. The reports of the examinations show what was already quite evident, namely; that Rocky Fork creek is grossly polluted by the sewage of Mansfield, and that this creek carries too small a volume of water to be used for carrying away the sewage of Mansfield. It is evident that this creek can no longer be used for this purpose and that some system of purifying the sewage of Mansfield must be provided to remove the nuisance now being occasioned by the city. I trust this matter will receive the earnest attention of your board, and that every effort will be made to bring about a better condition of the sanitary affairs of your city. If I can be of any further assistance to you, please inform me.

Yours truly,

C. O. PROBST,
Secretary.

REPORT OF THE ENGINEER.

Mansfield is situated very near the head waters of the Rocky Fork of Mohican creek. At a point just below the city the creek has a watershed of 39 square miles. The city has a large amount of general manufacturing, including several machine shops, foundries, stove works, brick and tile yards, buggy factories, etc., also two breweries and the gas works.

Drainage. The facilities for natural drainage are excellent. The city is located on the west side of Rocky Fork on high ground, cut by the rather deep valleys of Ritter's and Toby's runs, branches of Rocky Fork. Surface water has but a short distance to flow before it will strike either of these two branches or the creek itself. Ritter's run is arched over in a number of places and is gradually turning into a large sewer, Toby's run is a larger stream and is uncovered as yet.

Sewerage. Mansfield has the combined system of sewers with two outlets to Rocky Fork and one to Ritter's run. The outlet to Ritter's run and one of those to Rocky Fork are for cellar and yard drains only, and carry but little sewage. There are only 9.7 miles of sewers in, about one mile of which consists of cellar drains. The sewers cover only the central portion of the city including the business and most of the better residence districts. They are accessible to perhaps some 30% of the city's population. Vaults, cess pools, water closets, everything, are allowed to connect to the sewers, so that probably 50% of those in reach of the sewers are connected to them. This does not represent the total num-

ber of people sending sewage to the streams, however, as both Ritter's and Toby's runs have a large number of private sewers emptying into them, the former having the most. These private sewers bring in a large amount of surface drainage together with true sewage, the latter is not supposed to be admitted, but it is going in nevertheless. It would take a house to house examination to determine the exact amount of this sewage and it would take the same to determine the amount entering the city sewers, as even all water closets in use are not recorded. It is probably a safe estimate to say that the sewage of some 4,000 people finds its way to Rocky Fork, most of which is brought in by the large trunk sewer entering the creek just south of Orange street. The breweries and gas works are sewered together with a number of other plants, the latter having no objectional manufacturing refuse, however.

Vaults are constructed in any and every manner, some use plank boxes, others brick vaults, others mere holes in the ground. Very few of these, except the boxes, are ever cleaned: when they become full, they are covered over and new ones dug. Cess-pools are dug through the surface soil and clay into the gravel so that the water will be easily drained away. In a few cases, old wells have been used for this purpose.

Condition of the Creeks. In dry weather it is said that parts of both Toby's and Ritter's runs become very foul from the accumulated sewage, but at present they are not objectionable. The small amount of sewage is not visible at the outlets to these runs to Rocky Fork. Ritter's run is the smaller stream and has during dry weather much more sewage than it can carry in its present condition. Its dry flow must be taken care of by means of a small tile laid in its bottom or the whole creek must be converted into a large combined sewer. If the small tile is used, the sewer connections must be made to it. Toby's run has a few private sewers emptying into it and as its volume is larger there has been but little complaint.

The condition of Rocky Fork is at present unbearable, and in dry weather it will become very much worse. The stream has long level stretches in which the heavy matter in the sewage is deposited, forming a thick layer of foul mud, from which bubbles of gas constantly arise. The water is thick and greasy, nothing but putrid sewage, much more objectional than fresh sewage would be. This condition holds for 4 or 5 miles below Mansfield, showing the large amount of sewage present. This stream can only be improved by purifying the sewage before it is turned into it. As the stream is not used for a public water supply, the purification need only be extensive enough to remove the gross matter in the sewage so that no nuisance will be caused. Of course as the amount of sewage increases, the more perfect must the purification be as the stream is only capable of disposing of a definite amount of sewage matter.

Above the city the effluent from the Mansfield Reformatory sewage farm enters Rocky Fork but this causes no visible pollution. (See below.)

Water Supply. The public water supply is from three gangs of driven wells, all located in the northern part of the city. These wells average 180 feet in depth and are probably not influenced by the polluted subsurface water of the city. Two of the sets of wells obtain their water, it is said, in a quicksand above the rock, and one set on the sandstone itself. The water flows and is pumped from the various wells to a large pump well from which it is pumped direct to the city mains. About 70% of the population has access to the water mains. There are 1,950 services in use representing about 11,000 people, a little more than half of the city. Where the city water is available it is in general use. The private water supply is from dug wells which are from 30 to 50 feet deep and obtain their water from the gravel deposits in the drift. The water must be badly polluted by leachings from vaults and cess-pools. Well water and filtered cistern water must be used for domestic purposes by nearly one-half of the people. The use of filtered cistern water is not extensive.

Mansfield Reformatory. This institution is situated on high land $\frac{1}{2}$ mile west of north of the city. It has 348 inmates and 60 officers and attendants. Its water supply is from a spring $\frac{1}{4}$ mile north of the institution. This spring is situated at the bottom of the range of sandstone hills which runs along the east side of the Reformatory. It is carefully walled up and housed over and is free from surface pollution as long as the house yard in which it is situated is kept in a clean and tidy condition. The average daily consumption is about 70,000 gallons.

The sewage is disposed of on an intermittent filtration bed situated on the low land west of the prison. There are in all one and one-fourth acres divided into two large beds by an earthen embankment and these beds are again subdivided by small earthen ridges making five beds in all. The beds are formed of crushed sandstone from a neighboring quarry and are $4\frac{1}{2}$ feet thick. The surface is corrugated with ridges and gutters with an extreme difference of level of 18 inches. Into the gutters the sewage is flowed, it then passes down through the sandstone and is collected by suitable underdrains and led to the nearby creek. First the sewage enters an automatic flush tank, where it is collected and discharged onto the beds periodically, entering the small sections alternately as regulated by the attendant. The effluent is clear and very nearly colorless and causes no nuisance in the creek, but the analysis shows that the purification is by no means complete.

Respectfully submitted,

B. H. FLYNN, C. E.

REPORT OF THE CHEMIST AND BACTERIOLOGIST.

SAMPLES COLLECTED AT MANSFIELD, ROCKY FORK CREEK, ABOVE AND BELOW,
MAY 4TH AND 29TH, 1899.

PARTS PER MILLION.

	Above.	Below.	Above.	Below.
No. sample	415	414	476	474
Color .....	.15	.23	.42	.28
Turbidity .....	.06	.07	2.90	3.00
Sediment	slight	considerable	considerable	much
Odor	none	foul	earthy	foul
Oxygen required	2.42	5.81	29.80	39.94
Nitrogen as Ammonia free....	.081	.708	.044	.128
Nitrogen as Amm. albuminoid	.170	.372	1.432	.636
Nitrogen as nitrates.....	.03	.10	.08	.15
Nitrogen as nitrites.....	.008	.160	.003	.016
Chlorine	1.3	14.4	2.8	10.9
Alkalinity	197.6	201.6	54.5	130.3
Incrusting constituents	46.9	27.5	trace	49.3
Total solids	421.	404.	1168.	1535.
Volatile and combustible.....	124.	113.	117.	206.
Bacteria per c. c.....	775.	73870.	5710.	439800.

The addition of the garbage and sewage of Mansfield causes an excessive pollution of the Rocky Fork at that place. The extent of this pollution is shown best by the samples taken May 4th, as the river was at flood height on May 29th, when the late samples were taken. The increase below town from that found in the above town samples should be observed in the chlorine, nitrous acid, oxygen required, albuminoid ammonia and especially in the odor, bacteria and free ammonia. The amount of nitrogen as free ammonia (.708 parts per million) found below town May 4th, is an unusually high figure for even a polluted river. With low water conditions I should anticipate a nuisance beyond description by mere words.

E. G. HORTON,
Chemist and Bacteriologist.

REPORT UPON THE POLLUTION OF THE SANDUSKY RIVER AT TIFFIN.

To the State Board of Health,

GENTLEMEN:—The following communication was received from Mr. Smith W. Bennett, counsel for the Children's Home located near Tiffin:

COLUMBUS, July 19th, 1899.

To the Secretary of the State Board of Health,

DEAR DOCTOR:—I herewith file with you a formal complaint upon which I desire immediate action to be taken, if the duties of your Board will not conflict therewith. Please inform me what, if any, action is taken thereon, as the condition set forth in the accompanying complaint is certainly alarming.

Very truly yours,

SMITH W. BENNETT,

COLUMBUS, OHIO, July 21, 1899.

To the State Board of Health,

GENTLEMEN:—I beg to call to your attention a condition existing near the city of Tiffin, Ohio, which is in our opinion detrimental to the public health and productive of contagious and infectious diseases, as follows:

The National Council of the Junior Order of the United American Mechanics, purchased a farm consisting of one hundred and seventy-seven acres, within one mile of the city of Tiffin, Ohio. Upon this they have erected various cottages for the accommodation, maintenance and education of the orphans of deceased members of that Order. There are now located within these cottages upon the premises in question, about one hundred children, varying in ages from five to fifteen years, and their source of water supply for culinary purposes has been a stream which flows diagonally through the one hundred and seventy-seven acre farm, and across which stream there has been constructed a dam, for the purpose of intercepting the flow of water and securing more water for the purposes incidental to the farm, and the supply for the laundry and culinary purposes used within the cottages.

Upon a tract of land consisting of thirty-three acres, located about forty rods from the one hundred and seventy-seven acre farm, and through which the same stream of water runs, hereinbefore described, the American Straw Board Company has located one of their plants, and the offal and washings incidental to the production and manufacture of their product, discharges into and upon a low piece of land about ten or fifteen acres in extent, and the same is only separated from the stream in question, by an artificial bank thrown up through which there are two gates or apertures, permitting the washings aforesaid, at certain times, to percolate and flow through and into the stream in question. The washings consist of a foul and offensive solution; being a mixture of certain acids with dirty water, and the same has accumulated in such extent that it now forms a body about fifteen acres in extent, with an average depth of about five feet; from this body of washings, the foulest and most offensive odors arise continuously, and the same is at the present time,

by reason of the faulty construction of the gates, permitted to percolate through and into the stream from which the water supply in question is obtained.

We are informed by the superintendent of the institution that the bath water and water used for culinary purposes, contains this odor when used within the cottage aforesaid, and that the same has become so impure, offensive and disagreeable as not only to render it unfit for use for any purpose, but the cattle used upon the farm, from which are obtained the milk supply for said inmates, will not use the same, and no other means thus far has been provided for any other supply. If this is persisted in by said Straw Board Company, in the opinion of the undersigned, it would affect the health of the inmates of said orphans' home, as well as every person in the immediate vicinity.

These premises lying outside of the city of Tiffin, it is said the board of health of said city has not the power to act, and no Board will act with sufficient promptness or efficiency; and as provided by Section 409-25 Revised Statutes of Ohio, there can be no question but what your Board can take cognizance of such a condition under the general rules and duties imposed upon you. We therefore call the above matter to your consideration and ask you to take such action with promptness and dispatch as your best judgment may direct, knowing that if the present condition is permitted to exist the same will be destructive of life and health in the vicinity of said premises.

The Board of Trustees of the Orphans' Home of the Junior Order United American Mechanics,

By SMITH W. BENNETT,
Attorney in fact.

About the same time letters were received from the board of health of Pleasant township, Seneca county, in which the Straw Board works above referred to are situated, and also from the health officer of Fremont. The latter sent me a notice which had been issued by their board of health and published in their papers, which was as follows:

"All consumers of hydrant water are hereby warned against using the same for drinking or cooking purposes, the polluted condition of the river rendering the water dangerous. O. H. Thomas, H. O."

In his letter to me the health officer states: "In your last report you state that Fremont is partly supplied with water from deep wells. As a matter of fact our water supply is taken wholly from the river and is a constant menace to the health of our people." I would say that when the Sandusky river was under examination I visited Fremont and at that time a considerable part of their water was being taken from deep wells.

This Board was called upon in August, 1893, to investigate a nuisance arising, as alleged, from the discharge of waste matter from the Straw Board works at Tiffin, whereby large numbers of fish were killed.

At that time I found a large number of dead fish in the river at Fort Seneca, which is about ten miles below Tiffin. Dead fish were found all along from this point up to within a short distance below the Straw Board works. Two years before that time, similar trouble having arisen, an indictment by grand jury was secured against the Straw Board company and the case was tried in Tiffin before the common pleas court. Suit was brought for violation of Section 6921 R. S., which provides that "Whoever corrupts or renders unwholesome or impure any water course, stream or water, shall be fined not more than \$500." The verdict was against the plaintiff.

I had a consultation with the manager of the works when I was there in 1893, and was informed that they expected to close down the works within a few days. This was done three days after my visit, so the nuisance was temporarily abated. The works remained closed till June 2nd, 1899. A new plan had been adopted for disposing of their waste products. Instead of discharging it direct into the river it was carried some distance to a reservoir, thirty or more acres in extent, provided with gates for the purpose of emptying the reservoir at the time when the river would be in flood. It appears that on or about the 15th of July, this year, the gates were opened and the reservoir partly emptied. It was claimed by the Straw Board Company that it was absolutely necessary to open the gates at that time in order to make some repairs. The day following, dead fish were noticed in the river. Mr. Lang, living at Fort Seneca, was employed by the manager of the Straw Board Company to bury the dead fish. He was engaged in this work July 19th to 22nd, and states that he buried from 160 to 170 bushels; and that dead fish were found as far down the river as the mouth of Wolf creek, some seventeen or eighteen miles below the Straw Board works. It might be noted that the river at this time, according to statements made, was not unusually low.

I visited Tiffin in company with Mr. Bennett, who is not only legal adviser for the Children's Home referred to, but is also acting as attorney-general in the absence of Mr. Monnett. We made an investigation of the river and the Straw Board works. All of the waste, except a slight overflow, was at this time being discharged into the reservoir, consequently but very little of it was reaching the river. The dead fish having been buried, there was no existing nuisance as regards the condition of the river. The reservoir was about two-thirds filled with waste discharge from the Straw Board works. The odor from the reservoir was noticeable at some distance from it, and near to it was quite disagreeable, so that one would not hesitate in pronouncing it to be a public nuisance. We visited the Children's Home, spoken of, and the superintendent stated that at times the odor was very noticeable at the Home, and was quite annoying. He was also concerned because the discharge from the reservoir when the gates were lifted, passes through a small creek flowing

through the grounds of the institution, and he depends upon this creek for a water supply for all but drinking purposes. The gates of the reservoir not being perfectly tight, there is at all times an escape of a more or less quantity of waste water into this creek. It might be said that this institution is a national children's home, containing at the present time over one hundred children, and which, it is expected, will be very materially added to in the near future.

Samples of water from the river above and below where it is receiving any discharge from the Straw Board works, and one from the reservoir containing the discharge, were taken for chemical examination. The analyses are as follows:

REPORT OF CHEMICAL EXAMINATION OF SAMPLES OF WATER COLLECTED AT
TIFFIN, OHIO, JULY 25, 1899.

PARTS PER MILLION.

	Sandusky river, just below Morrison creek.	At Seneca dis- tillery.	Reservoir at gate Big 4 bridge.
Number of sample.....	588	589	590
Color .....	.25	.25	3.00 off color
Turbidity	trace	trace	decided
Sediment	slight	slight	slight
Odor	musty	musty	extremely foul
Oxygen required	6.80	5.89	727.5
Nitrogen as ammonia free.....	.092	.240	.260 off color
Nitrogen as Ammonia albuminoid..	.382	.396	2.950 off color
Nitrogen as nitrates.....	.16	.11	.82 (?)
Nitrogen as nitrites.....	.010	.009	failed
Chlorine	230.4	222.8	probably very little
Alkalinity	175.2	182.8	981.0 (?)
Incrusting constituents	162.8	147.8	26.8 (?)
Total solids	928.	953.	3390.
Volatile and combustible	302.	317.	2300.
Dissolved oxygen at laboratory....			none

No. 588 from Sandusky river just below Morrison creek.

No. 589 from Sandusky river at Seneca distillery.

No. 590 from Straw board reservoir.

Sample 590 is the waste product from the Straw Board works and is a foul smelling liquid. It contains much organic matter of vegetable origin. This is shown by the very high nitrogen as albuminoid ammonia and the extremely high oxygen requirement. The greater part of the total solids disappeared on incineration, sustaining the idea of vegetable pollution. Many of the findings in this sample are only approximations, as the determinations are made by color titration and these could not be perfectly exact in a liquid the color of this sample. The test for

alkalinity showed the absence of free acid and the presence of considerable amounts of carbonates. The probable absence of chlorides, and the low incrusting constituents would indicate that but little acid had been added at any time to the water represented by this particular sample.

In reference to the pollution of the river by such refuse, I would say that I find but one reason why it should cause the death of fish in the river. The extremely high oxygen requirement shows that the refuse is greedy for oxygen and consequently would quickly rob an ordinary water of its free or dissolved oxygen when introduced into such a water. With water deprived of its dissolved oxygen the death of fish would be expected to follow.

After sample 590 had been received at the laboratory I made a test for dissolved oxygen by simply filling my test bottle by pouring some of the liquid into it. This would allow some oxygen to be taken up from the air but this was so speedily consumed that the test showed no free oxygen.

In comparing the results from samples 588 and 589 to see if the former shows any effect from the straw board refuse it should be remembered that but little of that refuse was entering the river at the time the samples were taken. However, sample 588 shows an increase in the oxygen requirement over 589, and as the oxygen factor is the important one in the straw board refuse, this would indicate that the sample taken below Morrison creek did contain some of the refuse. The Seneca distillery sample shows in the ammonias its nearness to the sewage of Tiffin. While the sample from below Morrison creek shows a marked drop from the Seneca distillery sample in the free ammonia, the albuminoid ammonia of the former is kept up by the vegetable matter in the refuse.

It is possible that the acid used for cleaning purposes might be a factor in the fish killing. If the acid is used intermittently and the sample were taken at a time when the acid was not coming down, the analysis would give no indication of the use of acid provided the sample was taken from the fresh refuse as it flowed to the reservoir. If the sample was taken from the reservoir itself it would represent the refuse of many days, and as the analysis of the sample shows no free acid, this would eliminate the acid as the cause of death among the fish.

E. G. HORTON, Chemist.

A conference was held with members of the board of health of Pleasant township, Seneca county, farmers living along the stream aggrieved by the nuisance, and the prosecuting attorney of Seneca county. On returning home I submitted the following communication to the attorney-general for his opinion:

COLUMBUS, OHIO, July 27, 1899.

Hon. F. S. Monnett, Attorney-General, Columbus, Ohio,

SIR:—The State Board of Health has been called upon by the health authorities of Pleasant township, Seneca county, and of the city of Fremont, Sandusky county, for assistance in securing the abatement of a nuisance arising from the discharge of waste material from the Straw Board works operated by the American Straw Board Company situated near the city of Tiffin, into a reservoir or settling basin, owned by said company, and from the reservoir or settling basin into the Sandusky river.

It appears that this reservoir was discharged into the Sandusky river on or about July 16, 1899, and that the river was thereby so polluted as to render it a public nuisance, detrimental to the health and comfort of persons residing along said river for a distance of twelve miles or more below the straw board works.

The city of Fremont, about twenty miles below the straw board works, makes use of the Sandusky river for a public water supply, and the above mentioned pollution has rendered the use of such water dangerous to life and health.

Following the opening of the reservoir on or about the 16th instant, and clearly as a result of it, large numbers of fish in the Sandusky river, for many miles below the straw board works, were killed. The decomposition of these fish greatly aggravated the nuisance. The reservoir itself, which is many acres in extent, is a nuisance and must continue to be a nuisance so long as waste from the straw board works is poured into it and allowed to there decompose. The noxious odors arising from this reservoir are detrimental to the health and comfort of all persons residing in its vicinity.

The immense quantity of waste material to be removed from said straw board works—from one and one-half to two million gallons daily—renders it highly probable that there will be frequent repetitions of the conditions brought about by the discharge of the reservoir on or about the 16th instant; and above mentioned, while there is reason to believe that there is daily more or less of a discharge of such matter into the river.

You are respectfully requested to instruct this Board as to the measures that can be taken to abate this nuisance by (a) the State Board of Health; (b) the board of health of Pleasant township, Seneca county, or other local boards concerned in the abatement of the nuisance; (c) the water works trustees or other municipal authorities of the city of Fremont; (d) the prosecuting attorney of the county in which the nuisance is committed or located; (e) private citizens aggrieved by said nuisance.

An early response will oblige,

Yours respectfully,

C. O. PROBST,
Secretary.

To this he replied :

COLUMBUS, OHIO, July 31, 1899.

Dr. C. O. Probst, Secretary State Board of Health, Columbus, Ohio,

DEAR SIR:—I have your esteemed favor of the 27th instant, relative to the nuisance created by the American Straw Board Company, as described by you in your communication, located near the city of Tiffin, Ohio, and in which you desire instructions from this department as to the measures that can be taken to abate this nuisance by, (1) The State Board of Health; (2) the Board of Health of Pleasant township, Seneca county, Ohio, or other local boards concerned in the abatement of the nuisance; (3) the water works trustees or other municipal authorities of the city of Fremont, (4) the prosecuting attorney of the county in which the nuisance is committed or located; (5) private citizens aggrieved by said nuisance.

Answering these in the order suggested, I would say that the State Board of Health derives its powers and authority from Chapter 21, Title 3, of the Revised Statutes of Ohio. The particular section which governs its powers, being denominated Section 409-25. Among other powers therein enumerated as delegated to State Boards of Health, said section contains the following:

“The State Board of Health shall have supervision of all matters relating to the preservation of the life and health of the people of the State” * * *

“It shall respond promptly, when called upon by the state or local governments and municipal or township boards of health, to investigate and report upon the water supply, sewerage, disposal of excreta. etc.”

Taking the whole chapter clear through, it appears that the State Board of Health, under the delegation of power contained in the above quotation, has a general supervisory power of all matters relating to the preservation of the life and health of the people of the State. Supervision of these matters is expressly granted to the State Board, but the execution of orders for the accomplishment of the purposes set forth in the act, seems by the Statutes to be relegated to the subordinate boards and other executive and ministerial officers. It thus expressly reserves to the State Board the right to make and enforce orders in local matters in certain emergencies; among others, where the local board of health has neglected or refused to act with sufficient promptness or efficiency. It would appear that where such boards have been established, whether they be in cities, villages or townships, the local board of health should execute the laws in conjunction with other officers; under the supervisory powers granted to the State Board, would be the direction to bring proper actions and direct that the law be executed.

Limiting this to the particular question suggested, I am of the opinion that no action could be instituted in the name of the State Board of Health, but that the condition of affairs prejudicial to the health and

life of the people may be called to the attention of the local boards and to other officers, having the power to execute the laws, and the execution of the same may be brought in various forms as hereinafter quoted, and also in the common law form for the suppression of nuisances. It lies within the domain and authority of your Board of Health, to declare (when examined into by you) any existing condition of affairs detrimental to the life and health of the people of the state to be a nuisance, and you may enforce it when no other power exists to enforce it.

As was said by the circuit court of Lucas county, in the 15 Ohio Circuit Court Report, 632, in speaking of the Local Board of Health in the city of Toledo:

"Clearly a Board of Health in the State of Ohio, has such power as the statute has conferred upon it, and probably has such implied power as is necessary to carry the express powers into effect."

And in another place the court says:

"It is unquestionable that the legislature can confer police power upon public officers for the protection of the public health. The individual right sinks in the necessity to provide for the public good; the only question has been as to the extent of the powers that should be conferred for such purposes."

The State of Ohio has named and provided for the appointment of officers in sufficient numbers to enforce all laws of the State, and orders made by your board and subordinate boards, relating to the preservation of the life and health of its people. These officers are distributed through townships, villages and cities, and the police officers, sheriffs, constables and other officers and employes of the state, may be called upon to enforce and execute such lawful orders, rules and regulations, made by your Board, as may be necessary in your opinion, to protect the life and health, and which you have full power to enact. To come to the solution directly, of the question proposed by you, I am of the opinion that the execution of your orders by the commencement of actions to attain the objects sought by your orders, must be brought and enforced through other officers and employes of the state, police officers, sheriffs, constables or local boards of health.

2. With regard to township boards of health, I find the authority vested in them within Section 2121-2122 of the Revised Statutes of Ohio. There we find that the trustees of the respective townships, constitute the board of health of such township, which means that portion of the township outside of the limits of any city or village; and such boards have been granted the most ample powers, having the same duties and powers as are imposed upon or granted to boards of health in all cities and villages. So that to get a full definition of their powers, an examination of the powers conferred upon the boards of health in cities and villages is made necessary. Such township board of health may also make such orders and regulations as it may deem necessary for the

public health and prevention or restriction of disease, and the abatement or suppression of nuisances. There is also a provision contained in section 2122, that all orders and regulations adopted by such boards, intended for the general public, shall be adopted, advertised, recorded and certified, as are ordinances of cities and villages; and the record thereof shall be given, in all courts of the State, the same force and effect as is given such ordinances. Under this grant of power, township boards of health may abate or suppress nuisances. If they make an order for that purpose it should be adopted, advertised, recorded and certified, as is provided by law for the adoption of ordinances in cities and villages. That is as provided by sections 1694-95-96 and 97 of the Revised Statutes of Ohio.

They can employ attorneys to advise them in such matters and for the purpose of abating and suppressing any nuisance. The township board of health of Pleasant township, has the undoubted right, in view of the facts as narrated in your communication of the 27th inst., to declare the condition now existing in said township to be a nuisance and employ counsel to bring such action as may be necessary to abate it.

3. As to the jurisdiction of the local authorities of the city of Fremont, to prevent the pollution of the Sandusky river, which as I understand from your communication is the source of their water supply, the same can be found within Section 2433 of the Revised Statutes of Ohio, which reads:

"The jurisdiction of any corporation owning water works to prevent or punish any pollution of the water, shall extend ten miles beyond the corporation limits."

The jurisdiction herein spoken of is the criminal jurisdiction which is specially given by that section, for the purpose of arrest and punishment of any person befouling, polluting or vitiating such water supply. This is not a limitation on the right to protect their water supply by civil action, as they can proceed by injunction or any adequate remedy against any corporation or person, no matter where situated, that should in any manner pollute or render unwholesome, the supply of water used by the city of Fremont.

Such action would of course have to be brought where jurisdiction could be obtained, and service of summons made on the defendant corporation. Any person may also file an affidavit or secure the indictment of any person or corporation which causes noxious, noisome or offensive smells, injurious to the health, comfort or property of individuals or the public, or which causes or suffers such noxious substance to be collected or to remain in any place to the prejudice of others, or the public, under Section 6921 of the Revised Statutes of Ohio, and such prosecution can be begun by any one in the neighborhood of the Sandusky river, the reservoir or stream thus vitiated and rendered noxious by the conditions referred to by you. In addition to this, the prosecuting attorney of the

county can have the corporation indicted for the creation and maintenance of the nuisance, and he can, in the name of the state, bring and maintain a civil action to abate the nuisance. He may proceed by injunction to enjoin the American Straw Board Company from the continuance of the nuisance; he may also have them arrested or indicted for vitiating a water supply, for all of which special authority is given to him by law.

The condition to which you have called my attention and upon which you have sought this opinion, is a matter which should be met and suppressed immediately.

Hoping that this has answered fully and definitely your communication, I remain,

Very truly yours,

F. S. MONNETT,
Attorney General.

On August 4th, Mr. J. B. Greer, manager of the Ideal Manufacturing Company of Chicago, called at the office with plans for purifying the waste from the straw board works at Tiffin. He stated that he had just come from Tiffin, where, in company with the president of the American Straw Board Company (which is operating the Tiffin plant) he had looked over the ground, and the president had requested him to present his plans to the State Board of Health for approval. He stated that it was his understanding that if the plans were approved by the State Board of Health the straw board company was prepared to immediately put in a plant. I told him that it would be necessary for the company to make application to this Board for approval of the aforesaid plans. Expecting the matter to be submitted to the Board by correspondence, he sent me eight copies of the plans and specifications, which I can present later, if desired.

A few days after this Mr. Snow, consulting engineer, telephoned me from Tiffin that he had held a consultation with the manager of the straw board works at Tiffin, Mr. Williams, with members of the city council of Tiffin, and other citizens, in reference to putting in a plant which would not only purify the waste from the straw board works, but also the sewage of Tiffin. He wished to know whether matters could be delayed until this project could be brought before the Board. Mr. Williams, manager of the works, telephoned me that he did not understand that the Ideal Manufacturing Company had been given the contract for putting in a purification plant. I replied to these messages that the plans submitted by the Ideal Manufacturing Company would not be brought before the Board for approval except upon the request of the American Straw Board Company and upon their representation that the plans had been adopted by them and that the plant would be put in, if they were approved by said Board; as it was the business of the straw board company and not of this Board to select plans. I then

wrote to the president of the American Straw Board Company, at Chicago, to be informed as to what they were proposing to do in the matter of purifying the waste discharge from their works at Tiffin, and received the following response:

CHICAGO, August 9th, 1899.

Dr. C. O. Probst, Secretary State Board of Health, Columbus, Ohio,

DEAR SIR:—I have your favor of the 8th instant. For some weeks past I have been figuring with Mr. Greer, manager of the Ideal Manufacturing Company, in regard to his filtering system. Last week as soon as I received the report that our settling pond at Tiffin was complained of by the State Board of Health I arranged with Mr. Greer to go to Tiffin with me and examine into the situation.

After spending all day Thursday, the third, in looking over the plant at Tiffin, Mr. Greer submitted to me a proposition for filtering the waste water. I told him that we had already spent \$15,000.00 or \$20,000.00 in building a settling pond under the supervision of the local authorities, and which they said would be entirely satisfactory, and that we could not afford to spend several thousand dollars more money unless we were sure the State Board of Health would approve of the work when it was completed.

I further told Mr. Greer that if your Board did approve of his plan, and he could demonstrate by a practical test (which he is about to make) that it is possible to filter the large volume of water which has got to be taken care of, we would accept his proposition and immediately install the plant. This plan of Mr. Greer's has never been tested, as I understand it, except on a small scale. He is now erecting experimental purifying works for the Paragon Paper Company at Eaton, Indiana, with a filtering capacity of 10,000 gallons of water per day. This filtering plant will be completed the last of this week or the first of next. The Paragon Paper Company have made a contract with Mr. Greer for a plant of a million gallons daily capacity, provided this experimental plant is effective.

I was talking with Mr. Fleming, Secretary of the Paragon Paper Company, today, and he is very confident that it is going to be a success. Our plant at Tiffin is about the same capacity and I have agreed with Mr. Greer that some officer of our company will be at Eaton as soon as the experimental plant is ready for a test, and if it is effective we will order a plant for Tiffin to be installed at once, provided the same will be satisfactory to the State Board of Health.

There is no doubt in my mind but what Mr. Greer thoroughly understands his business. The only question in my mind is whether it will be possible to pass through any filter he can construct the enormous volume of water required to be filtered. For this reason I have not left this matter open for any one solution, but instructed my manager at

Tiffin, Mr. A. E. Williams, to also get full information in regard to a proposition from the Dixon Garbage Crematory Company of Toledo, who think they can drain out the bulk of the water and then burn the balance of the refuse. I know this question of burning garbage in many of the large cities, especially in Europe, is regarded as the only effective solution of these troubles in regard to waste material.

This will explain to you that we are acting absolutely in the best faith with your Board by trying to find the best and most effective remedy for what you have condemned as a nuisance, and I will solicit your coöperation and advice to this end. We realize fully that this is a great problem requiring to be solved—not for any one plant of ours, but for the industries of the State.

Mr. Greer told me that he had invited you to be present at his test at Eaton, Indiana. I hope it will be possible for you to do so. It certainly is not policy to hamper the industries of the state any more than necessary for the protection of the health of the people which, of course, is paramount to all other considerations.

I regret extremely that I could not have met you personally at Tiffin. I think I would have had no difficulty in convincing you that our settling pond at Tiffin is in no sense injurious to any one's health. I have been constantly engaged about straw wrapping and straw board mills for nearly forty years, and I know of no more healthy class of people than those so employed. It is only within the last few years that any one has thought of complaining of the waste material from a straw board mill, which consists entirely of straw, and the lime in which the same is cooked.

Some five years ago our plant at Tiffin was closed down because the farmers down the stream complained that the waste emptied into the river killed the fish at periods of low water; and while there was no proof, and we did not believe that such was the case, during the following years of dull business we did not particularly need the mill, nor care to run it.

A few months ago we talked of moving the mill from Tiffin, but at the request of the citizens of that city I went there to investigate the subject, and on the assurance of the farmers down the river that if we would build a settling pond to retain our refuse at periods of hot weather and low water we should have no further trouble, I purchased the land where our settling pond is located, and with the advice and coöperation of the local authorities established this reservoir, expecting as agreed when the water was high late in the fall to empty it into the river at a time when the volume of water would be so great that this would never be noticed.

It seems that one of the head gates of the pond leaked a little and in taking a plank off to remedy this some water escaped, but it is impossible that enough could have done so, so that any fish would possibly have found it where they died—six miles down the stream.

I was consequently very much surprised when the complaint came to me from our settling pond, and naturally after having spent this amount of money we want to be sure we are right before we go ahead with the next experiment.

Trusting that this will be a satisfactory explanation of the whole subject, and assuring you that our company intends to act in entirely good faith with your Board, I am,

Yours truly,

R. F. NEWCOMB,
President.

P. S. I understand from Mr. Greer that your Board would suspend action against our company pending these experiments. I shall be glad of your assurance that this is correct. I shall be glad also to know that your Board will approve his plans, provided I find that they are mechanically effective.

N.

On August 10th, Judge McCauley and Judge Seney, attorneys for the American Straw Board Company, called at the office, in company with Mr. Bennett. The attorneys stated that the company stood ready to abate this nuisance by purifying their waste products regardless of expense, but wished to be assured that money spent for that purpose would accomplish the desired end. It was agreed that no further action would be taken in this matter until after the meeting of the Board on the 16th instant, and that I should recommend to the Board that the Company be allowed a reasonable time in which to satisfy itself as to the claims of the Ideal Manufacturing Company to purify waste from straw board works, to be demonstrated by their experimental plant being erected at Eaton, Indiana.

On the next day I received the following communication from the clerk of the Pleasant Township Board of Health:

OLD FORT, OHIO, August 10th, 1899.

C. O. Probst,

DEAR SIR:—The citizens along the river had a meeting last night and passed a resolution requesting the Pleasant township board of health to take counsel and the necessary steps to abate the nuisance caused by the Straw Board Works at Tiffin.

Now, we want the assistance of the State Board, and if it is not asking too much we wish you would confer with the Attorney-General and find what is the best way to proceed. The attorneys at Tiffin are not yet quite agreed as to the way to proceed. One says it is to ask the court for a permanent injunction, another to get, if possible, an indictment, and another for the board to ask them to abate the nuisance, etc.

The prosecuting attorney is away from Tiffin for about two weeks, and we got advice from Schroth (ex-Prosecutor) and Nelson B. Lutz.

We want to proceed aright and want your advice in the matter.

Yours very truly,

L. N. MONTGOMERY,

Clerk Board of Health.

I informed the clerk of the board of the proposal of the company to abate the nuisance by purification works, and that the matter would come before the State Board at its meeting to be held on the 16th instant.

Respectfully,

C. O. PROBST,

Secretary.

Evidence was taken by the Grand Jury of Seneca county on October 25th, and the American Straw Board Company was indicted for creating and maintaining a nuisance. The case has not yet come to trial.

REPORT UPON AN INVESTIGATION OF AN ALLEGED NUISANCE FROM A GARBAGE CREMATORY AT TOLEDO.

To the State Board of Health,

GENTLEMEN:—On July 18th I went to Toledo to investigate an alleged nuisance arising from odors from a garbage crematory erected within the city limits. Complaint was made to this board by citizens living in the neighborhood of the crematory. I learned that a company had erected a garbage crematory on the outskirts of Toledo, which was being run experimentally, the city of Toledo having nothing to do with the plant. I visited the crematory with the health officer, Dr. Grosh, and Dr. Hubbard. We questioned the people living in the neighborhood of the crematory, and they all testified that at times it emitted very offensive odors. Garbage was being burned at the time we were there, and the atmospheric conditions were such that the smoke hung close to the ground. The odor was not a particularly disagreeable one at that time and would scarcely be condemned as a nuisance other than a nuisance arising from smoke.

We inspected the crematory and witnessed its operation. The garbage is burned by coal, a high temperature being attained by means of an air-blast. The manager of the plant stated that he was burning only small quantities of garbage and that the experiments they were conducting were soon to be completed. The health officer of Toledo

expressed his intention of preventing the maintenance of any serious nuisance at this place, and I think it does not require any further attention from this Board, at least at this time.

Respectfully submitted,

C. O. PROBST,
Secretary.

REPORT UPON AN INVESTIGATION OF THE POLLUTION OF THE WATER SUPPLY OF WELLSTON.

To the State Board of Health,

GENTLEMEN:—On September 6th I went to Wellston, and from there to Hamden, six or seven miles distant, to inspect a slaughter house said to be polluting the water supply of Wellston. A member of the Wellston board of health went with me.

We found in effect, in Hamden, an exceedingly filthy slaughter house, located on a side-hill draining to a small creek. The entrails and other offal from slaughtered animals were habitually thrown onto the side-hill in a lot in which hogs were kept. The place was foul beyond description. The creek receiving this drainage, after a short flow, enters a branch of Raccoon creek. The water supply of Wellston is taken from this creek about six miles below. Fortunately Wellston is provided with a reservoir holding a supply sufficient for eighty or ninety days' use, so that the water is not pumped directly from the creek at all times. Nevertheless, this slaughter house in Hamden must be a serious menace to the purity of the water supply of Wellston.

Returning home the question of abating this nuisance was submitted to the attorney-general, who gave the following opinion:

COLUMBUS, OHIO, September 8th, 1899.

C. O. Probst, M. D., Secretary State Board of Health, Columbus, Ohio,

DEAR SIR:—I have the honor to receive from you a communication under date of September 8th, in which you state that the city of Wellston, Jackson county, Ohio, has public water works, and obtains its water supply from a small creek into which a slaughter house is permitted to discharge much filth and material, by emptying into a brook that discharges into such creek, and you inquire what is the proper body to begin necessary action to abate the nuisance thereby created, and just what steps such body should take to have the slaughter house removed.

My answer to the same is as follows:

I. The owners of the slaughter house or the parties responsible for its condition, may be prosecuted criminally, by any one, under Section 6921 of the Revised Statutes of Ohio.

2. The city of Wellston may prosecute the owners of the slaughter house or those responsible for its condition, under Section 2433 of the Revised Statutes of Ohio.

3. The township board of health of the township in which the village of Hamden, Vinton county, Ohio, is situated, may begin an action by injunction under the powers conferred upon them by Section 2116 of the Revised Statutes of Ohio, and thereby abate the nuisance created. Under Section 2121 of the Revised Statutes, the township board of health, consists of the trustees of the township, and if this particular nuisance is outside of the village of Hamden, the action should be brought by the township board of health, and if within the village of Hamden, there is a village board of health, the action should be brought by the village board of health.

4. Further, I have no doubt whatever, that the city of Wellston, if it owns the water works in question, can itself commence an action by injunction against the parties maintaining such slaughter house, enjoining them from permitting the filth to discharge into such brook, and can apply to a court having equity powers for a mandatory injunction abating such nuisance.

This would have to be done by the employment of counsel and the filing of a petition in the court of common pleas of the county in which the nuisance existed. The details of the proceedings necessary would be familiar to any attorney of experience.

Hoping that this has fully answered the questions propounded by you, I am

Yours very truly,

F. S. MONNETT,
Attorney-General.

A copy of this was sent to the board of health of Wellston under date of September 11th, and the board of health reported on October 12th "The council of Hamden organized a board of health, and that terrible slaughter house we located by scent and which contaminated the Wellston water supply, is now being removed far away. In future I apprehend no further contamination from that source."

Yours truly,

C. O. PROBST,
Secretary.

LABORATORY EXAMINATIONS.

DIPHTHERIA EXAMINATIONS.

Case No.	Place.	Age.	Sex.	Color.	Temperature.	Physician's Diagnosis.	Membrane Present.	Day of Disease.	Mo.	Day.	Date Received.	Result of Examination.	Remarks.
22	Maunee.....	7	f	w	98	Diphtheria	Yes....	2	1	9	4	+	Committee of three physicians said was not diphtheria. Specimen was a gargle of warm water. Second examination.
23	Rockford.....	4	m	w	a	Doubtful.....	a.....	11	1	9	11	+	
24	Greenspring.....	12	f	w	99	.....	a.....	11	4	11	14	+
25	Bellevue.....	17	m	w	103	Follicular tonsillitis.....	Yes....	11	9	22	14	+	
26	Geneva.....	45	m	w	103½	Ulcerated tonsillitis (?).....	Yes....	11	9	22	14	+	Had mild tonsillitis weeks ago.
27	".....	23	m	w	103	Follicular tonsillitis (?).....	Yes....	11	9	22	14	+	
28	".....	5	m	w	99.5	Diphtheria croup	Yes....	11	9	22	14	+	
29	".....	13	f	w	101	Diphtheria (?)	Yes....	14	9	7	14	+	
30	Andover.....	13	a	w	a	a.....	a.....	11	9	26	14	+	
31	".....	8	a	w	a	Suspicious.....	a.....	11	9	26	14	+	
32	Waverly.....	6	m	w	a	Primarily tonsillitis.....	Yes....	11	10	25	14	+	
33	Vermilion.....	12	f	w	100	Diphtheria.....	Yes....	11	10	25	14	+	
34	".....	23	f	w	a	a.....	a.....	11	11	29	14	+	

+ Diphtheria bacilli present. — Diphtheria bacilli not found. * a Unreported. † examinations, 12 positive.

On November 23, three samples of blood were received from Painesville, having been taken from patients suspected of having typhoid fever. Each of the three samples resulted negatively on application of the Widal test.

A sample of supposed tuberculous sputum was received November 17 from Lima. Examination revealed the presence of tubercle bacilli.

MISCELLANEOUS EXAMINATIONS.

Case No.	Place.	Nature of Specimen.	Source.	Date received.		Examined.		Result of Examination.	Remarks.
				No.	Day.	By request of	For.		
31	Cedarville.....	Meat.....	"Black" Hog.....	1	9	Health officer.	Trichina.....	Trichina present.....	These three samples were not labeled individually.
32	"	"	"Red" Hog.....	1	9	"	"	" not found.....	
33	"	"	"Young" Hog.....	1	9	"	"	"	
34	"	"	"Red" or "Young" Hog.....	1	14	"	"	"	
35	"	"	"	1	14	"	"	"	{ First portion of blood used for Widal test. Balance not satisfactory. } Moderately good. Unsatisfactory Filters not operated satisfactorily.
36	Macbride.....	"	Hog.....	1	18	"	"	"	
37	Van Buren.....	"	"	1	18	"	"	"	
38	Sidney.....	Ice.....	"	1	25	Dr. Elwell.....	"	" present.....	
39	"	"	"	1	11	Health officer.	Pollution.....	2,210 bacteria per c.c. No colon.....	
40	Delaware.....	"	Olentangy River.....	1	11	Health officer.	"	Colon present.....	
41	"	"	Greenwood Lake.....	1	11	"	"	Suspicious organism.....	
42	Tippencanoe City.....	"	"	5	9	"	"	No colon.....	
43	Glendale.....	"	Lake.....	5	16	"	"	"	
44	"	"	"	5	16	"	"	"	
45	"	"	"	5	16	"	"	"	
46	"	"	"	4	31	"	Tubercle bacilli.....	Tubercle bacilli present.....	
47	Tiro.....	Pus.....	Human foot.....	1	31	"	"	"	{ First portion of blood used for Widal test. Balance not satisfactory. } Moderately good. Unsatisfactory Filters not operated satisfactorily.
48	Painesville.....	Blood.....	Human.....	11	23	Dr. C. O. Probst.....	Malaria.....	Negative.....	
49	"	"	"	11	23	"	"	"	
50	"	"	"	11	23	"	"	"	
51	Lorain.....	Sulphate of alumina (used in mechanical filtration of water.) Railway coach.....	"	11	27	Health officer.	Quality.....	Insoluble matter..... Al ₂ O ₃ Sulphuric acid (SO ₃)..... Water (H ₂ O)..... Lime (CaO)..... Oxide of iron..... See below.....	
42	Columbus.....	"	"	1	13	State Bd. of H.	Disinfection test.....	"	{ First portion of blood used for Widal test. Balance not satisfactory. } Moderately good. Unsatisfactory Filters not operated satisfactorily.
43	Lakeside.....	Effluents.....	"	4	13	"	Efficiency.....	"	

LAKESIDE FILTER TEST. JULY 30 AND 31, 1899.

Sample Number.	Date.		Hour.	Source of Sample.	Bacteria per c. c. unfiltered.	Bacteria per c. c. filtered.	Reduction per c. c.	Reduction in percentage.	Remarks.
	Mo.	Day.							
634	7	31	2:30 p. m.	From filter tank.	382	.....	.....	.....
635	7	31	2:30 p. m.	Tap at hotel.....	.....	184	198	52	
636	7	31	5:30 p. m.	From filter tank.	131	.....	.....	.....
637	7	31	5:30 p. m.	Huntsberger tap.....	.....	41	90	69	The Huntsberger tap is near the filter.
638	7	31	5:30 p. m.	Tap at hotel.....	.....	87	44	34	
639	7	31	8:30 p. m.	Carroll tap. (On intake line.).....	80	.....	.....	.....
640	7	31	8:30 p. m.	Fountain in front of office.....	.....	309	Increase.	.....	Fountain in constant use, with more or less splashing.
641	7	31	8:30 p. m.	Tap at hotel.....	.....	40	40	50	
642	7	30	4:30 a. m.	" .....	.....	157	50	24	
643	7	30	8:30 a. m.	Carroll tap.....	297	.....	.....	.....
644	7	30	8:30 a. m.	Huntsberger tap.....	.....	21	186	90	
645	7	30	8:30 a. m.	Tap at hotel.....	.....	76	131	63	
602	7	30	10:15 a. m.	Carroll tap.	58	.....	.....	.....	Chemical analysis also.
601	7	30	10:15 a. m.	Huntsberger tap.....	.....	55	3	5	Chemical analysis also.
646	7	30	10:15 a. m.	Tap at hotel.	.....	68	Increase.	.....
				Average.	172	81*	91	53	

* In determining the average the result for test No. 7 was omitted owing to surroundings.

Attention is called to the low number of bacteria in the unfiltered water, and also to the fact that the regulators were not on the filters at the time the test began, but were soon put in place only to be removed some time the next morning. The chemical analysis of the raw water and the effluent are given below :

PARTS PER MILLION.

	Filtered.	Unfiltered.
Source	Huntsberger tap	Carroll tap
Test number	14	13
Sample number	601	602
Color .....	.05	.10
Turbidity	none	slight
Sediment	none	trace
Odor	none	none
Oxygen required	1.70	2.54
Nitrogen as free ammonia.....	trace	trace
Nitrogen as albuminoid ammonia.....	.062	.072
Nitrogen as nitrates.....	trace	trace
Nitrogen as nitrites.....	none	none
Chlorine	11.0	11.2
Alkalinity	99.4	99.8
Incrusting constituents	31.4	30.2
Total solids	169.	177.
Loss on ignition.....	56.	82.

RECORD OF CHEMICAL EXAMINATIONS OF COLUMBUS WATER.
PARTS PER MILLION.

Sample Number.	Source of Sample.	Date Collected.			Turbidity.	Sediment.	Odor.	Oxygen Required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting Constituents.	Total Solids.	Loss on Ignition.
		Month.	Day.	Year.					Albuminoid Ammonia.	Free Ammonia.	Nitrites.	Nitrates.					
318	Tap in State Board of Health Laboratory..	2	18	'99	Very slight.	Trace	None ...	3.13	.108	.018	.005	.19	11.6	259.6	79.2	670	199
371	"	3	30	'99	Distinct ...	Slight	"	2.55	.102	.034	.004	.29	14.8	223.3	147.2	635	151
437	"	5	11	'99	Very slight.	Very slight.	"	3.73	.151	.015	.003	.09	13.1	227.0	134.5	608	170
493	"	6	7	'99	Decided	Slight	Earthy	8.96	.236	.013	.005	1.62	9.9	181.4	73.4	528	161
551	"	7	14	'99	Very slight.	"	None ...	3.71	.123	.006	Trace	.06	10.6	184.2	107.0	609	221
693	"	9	12	'99	Decided	"	Earthy	7.84	.238	.011	.001	.08	10.0	184.4	143.8	583	161
864	"	12	5	'99	Slight ..	Trace	None ...	2.02	.074	.021	.003	.11	15.1	243.4	204.6	778	230

BACTERIOLOGICAL EXAMINATIONS OF COLUMBUS WATER.

Sample number.	Collected.		Hour.	Appearance of water.	No. of bacteria per c. c.	Remarks.
	Mo.	Day.				
277	1	9	8 a m	very roilly	5,220	Putrefactive.
278	1	10	10 a	roilly	4,740	
279	1	11	8:30 a	cloudy	9,220	
280	1	12	10 a	hazy	11,060	
281	1	13	9 a	"	5,300	
282	1	14	10 a	very roilly	8,670	
283	1	16	9 a	roilly	19,300	
284	1	17	9 a	"	11,385	
285	1	18	12 n	hazy	10,000	
286	1	19	10 a	"	10,420	
287	1	20	8 a	"	12,200	
288	1	21	9 a	nearly clear	7,850	
290	1	23	9 a	clear	962	
291	1	24	11 a	hazy	2,150	
292	1	25	12 n	nearly clear	430	
293	1	26	10 a	clear	662	
294	1	27	8 a	"	495	
295	1	28	12 n	hazy	1,280	
296	1	30	9 a	"	1,062	
297	1	31	5 p	"	1,180	
298	2	1	11 a	nearly clear	1,472	
299	2	2	11:30 a	"	1,131	
300	2	3	10 a	"	826	
301	2	4	9 a	clear	712	
302	2	6	9 a	"	240	
303	2	7	9 a	"	590	
304	2	8	10 a	"	736	
305	2	9	12 n	"	589	
306	2	10	9 a	"	1,844	
307	2	11	8 a	"	1,020	
308	2	13	9 a	clear	280	Colon present, chemical analysis.
309	2	14	9 a	"	369	
310	2	15	10 a	"	375	
311	2	16	9 a	"	415	
312	2	17	12 n	"	832	
313	2	18	9 a	"	3,900	
319	2	20	8:30 a	"	16,500	
320	2	21	9 a	"	7,650	
321	2	22	9 a	"	16,300	
322	2	23	8 a	hazy	16,500	
323	2	24	9 a	"	13,000	
324	2	25	8 a	"	20,000	
325	2	27	9 a	cloudy	11,380	
326	2	28	8 a	roilly	15,100	
331	3	1	8:30 a	"	13,400	
332	3	2	9 a	faint roilly	11,000	
333	3	3	9 a	"	5,900	
334	3	4	9 a	"	8,900	
335	3	5	8 a	"	16,400	
366	3	6	8:30 a	cloudy	14,100	
337	3	7	8 a	"	8,800	
338	3	8	8 a	"	5,300	
345	3	9	8 a	"	4,400	
346	3	10	10 a	clear	2,100	
347	3	11	10 a	"	1,800	
348	3	12	12 n	"	1,400	
349	3	13	1 p	"	700	
354	3	14	10 a	"	2,300	

COLUMBUS WATER — Continued.

Sample number.	Collected.		Hour.	Appearance of water.	No. of bacteria per c. c.	Remarks.
	Mo.	Day.				
355	3	15	8 a	faint hazy	2,600	
356	3	16	7:30 a	clear	900	
357	3	17	10 a	"	600	
358	3	18	3 p	clear	400	
359	3	20	8 a	hazy	5,100	
360	3	21	10 a	"	5,400	
363	3	22	2 p	"	5,200	
364	3	23	8 a	cloudy	14,200	
365	3	24	9 a	"	10,500	
366	3	25	11 a	hazy	7,500	
368	3	27	9 a	"	3,800	
369	3	28	12 n	"	3,700	
370	3	29	10 a	"	4,000	
371	3	30	10 a	"	1,400	Chemical analysis.
373	3	31	10 a	"	1,200	
374	4	1	2 p	faint hazy	1,200	
375	4	3	2 p	"	1,000	
377	4	4	11 a	clear	1,100	
378	4	5	9 a	"	650	
379	4	6	2 p	"	800	
380	4	7	1 p	"	325	
381	4	10	9 a	"	800	
382	4	11	10 a	"	450	
383	4	12	9 a	"	450	
384	4	13	2 p	"	275	
385	4	14	9 a	"	275	
386	4	15	1 p	"	550	
387	4	17	10 a	"	350	
388	4	18	11 a	"	250	
389	4	19	10 a	"	325	
390	4	20	8 a	"	200	
391	4	21	11 a	"	400	
392	4	22	8 a	"	325	
393	4	24	10 a	"	425	
394	4	25	10 a	clear	325	
395	4	26	10 a	"	475	
396	4	27	10 a	"	650	
435	5	9	3 p	"	400	
436	5	10	1 p	"	850	
437	5	11	10 a	hazy	500	Chemical analysis.
443	5	12	10 a	"	450	
444	5	13	8 a	"	350	
447	5	15	8 a	"	250	
448	5	16	8 a	clear	275	
453	5	19	2 p	"	250	
456	5	20	2 p	"	130	
457	5	22	9 a	"	500	
492	6	6	11 a	roilly	1,500	Chemical analysis.
493	6	7	9 a	"	1,100	
495	6	8	8 a	"	500	
496	6	10	12:30 p	"	650	
497	6	12	4 p	faint roilly	450	
498	6	13	4 p	hazy	1,000	
499	6	14	4 p	"	900	
500	6	15	10 a	"	950	
502	6	16	1 p	"	700	
540	7	1	10 a	"	2,000	
541	7	3	2 p	faint hazy	250	

COLUMBUS WATER — Concluded.

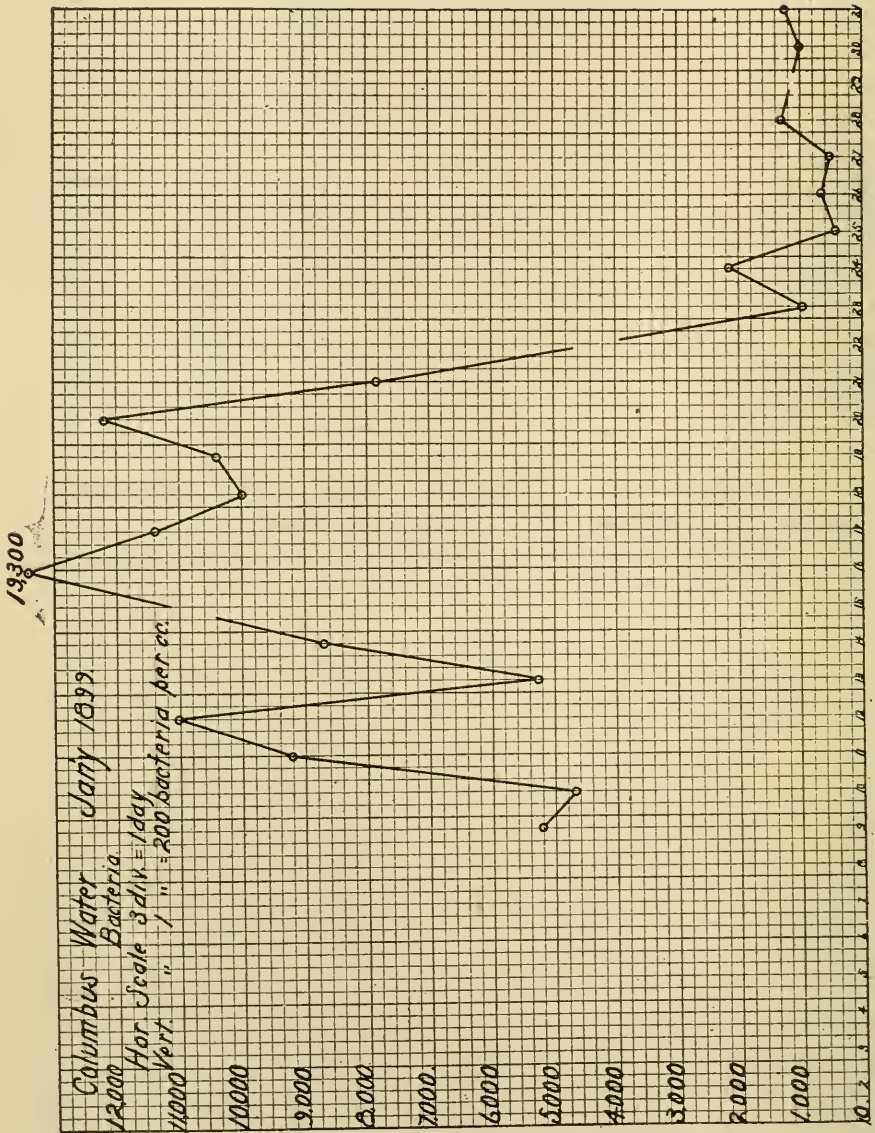
Sample number.	Collected.		Hour.	Appearance of water.	No. of bacteria per c. c.	Remarks.
	Mo.	Day.				
542	7	4	3 p	faint hazy	550	
543	7	5	10 a	"	800	
544	7	6	2 p	"	600	
545	7	7	10 a	clear	500	
546	7	8	11 a	"	1,100	
547	7	10	8:30 a	"	350	
549	7	11	2 p	hazy	475	
550	7	13	10 a	faint hazy	500	
551	7	14	9:30 a	"	2,400	Chemical analysis.
576	7	21	2 p	"	1,300	
580	7	22	11 a	"	900	
591	7	26	2 p	hazy	850	
599	7	28	10 a	faint roilly	220	
600	7	29	10 a	"	1,100	
620	8	21	2 p	faint hazy	1,200	
632	8	24	9 a	"	700	
633	8	25	11 a	"	750	
671	9	2	9 a	"	1,100	
672	9	3	3 p	clear	650	
673	9	4	10 a	nearly clear	750	
676	9	5	5 p	"	800	
677	9	6	2 p	"	600	Colon present.
680	9	7	11:30 a	"	350	
687	9	8	11 a	"	275	
688	9	9	3 p	"	1,600	
689	9	10	3 p	"	1,100	
690	9	11	3 p	"	1,300	
693	9	12	9 a	"	950	Chemical analysis, suspicious organisms present.
694	9	13	5 p	"	850	
717	9	22	3 p	"	600	
724	9	23	3 p	faint roilly	1,200	
739	9	29	3 p	nearly clear	850	
740	9	30	1 p	cloudy	1,000	
742	10	3	2:30 p	clear	1,000	
746	10	4	2 p	"	400	
751	10	5	2 p	"	850	
752	10	6	3 p	"	550	
796	10	20	8:30 a	"	650	
817	11	7	9:30 a	clear	450	
818	11	9	9 a	"	600	
821	11	10	9 a	"	900	
862	12	2	3 p	"	275	
863	12	4	2 p	"	190	
864	12	5	10 a	"	350	Chemical analysis.
868	12	6	1 p	"	300	
869	12	7	9:30 a	"	325	
873	12	9	3 p	"	120	Intermittently roilly.
874	12	13	1 p	"	600	
875	12	14	10 a	"	950	
876	12	15	10 a	"	475	
877	12	16	10 a	"	500	
878	12	18	11 a	"	1,900	
880	12	19	11 a	"	2,000	
881	12	23	10 a	hazy	2,800	
885	12	26	11 a	clear	3,100	
886	12	28	3 p	"	2,000	
887	12	29	10 a	"	600	
888	12	30	2 p	"	325	Intermittently [roilly.]

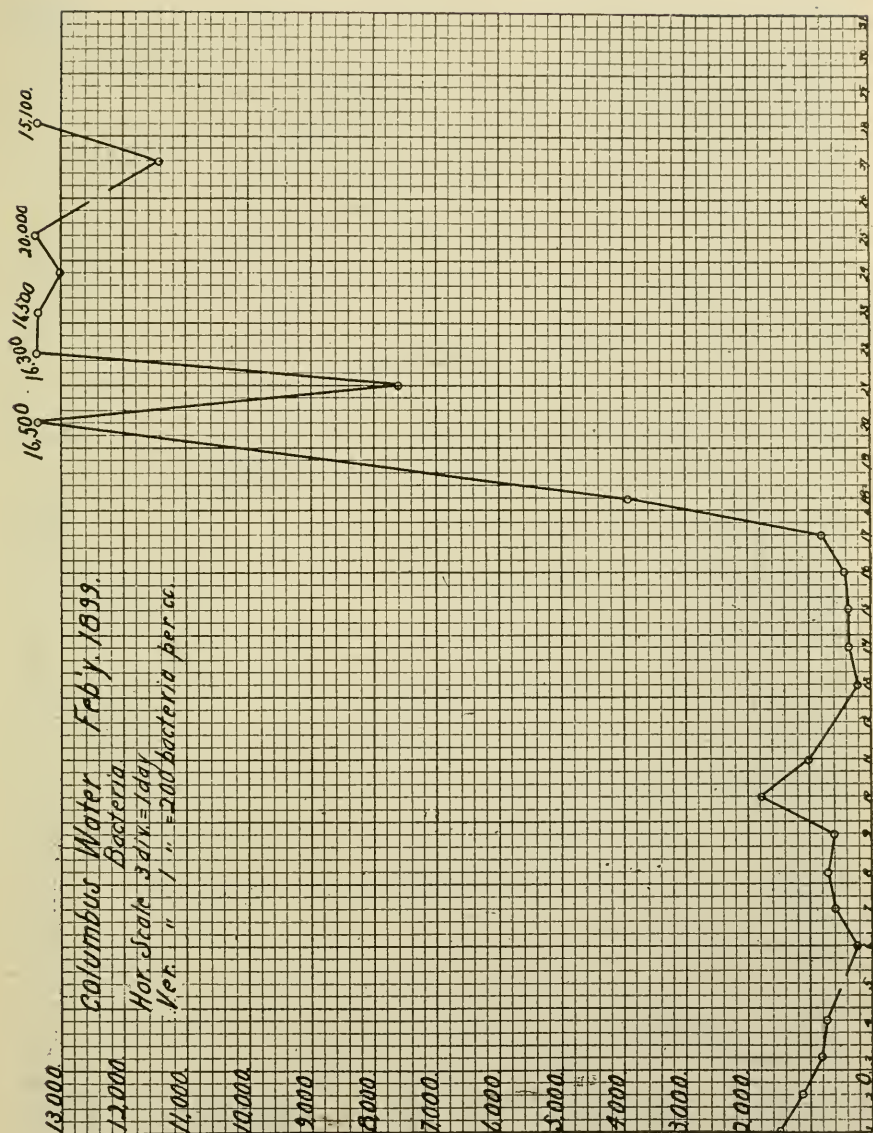
From the preceding table we derive the following monthly minimum and maximum findings together with the number of days the water was examined during 1899.

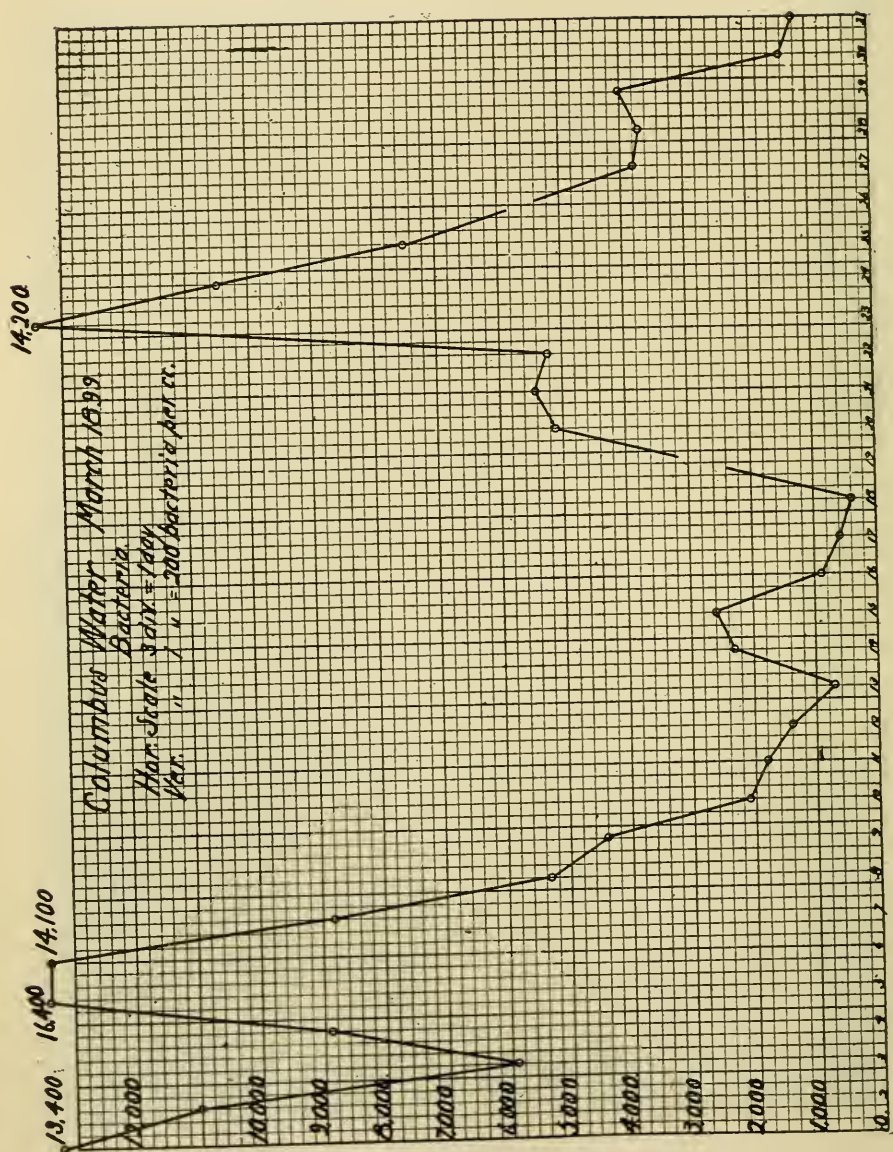
	No. of days examined.	Mini- mum No. of bac- teria.	Maxi- mum No. of bac- teria.
January	20	430	19,300
February	24	230	20,000
March	29	400	16,400
April	22	200	1,200
May	10	130	850
June	9	450	1,500
July	16	220	2,400
August	3	700	1,200
September	16	275	1,600
October	5	400	1,000
November	3	450	900
December	17	120	3,100

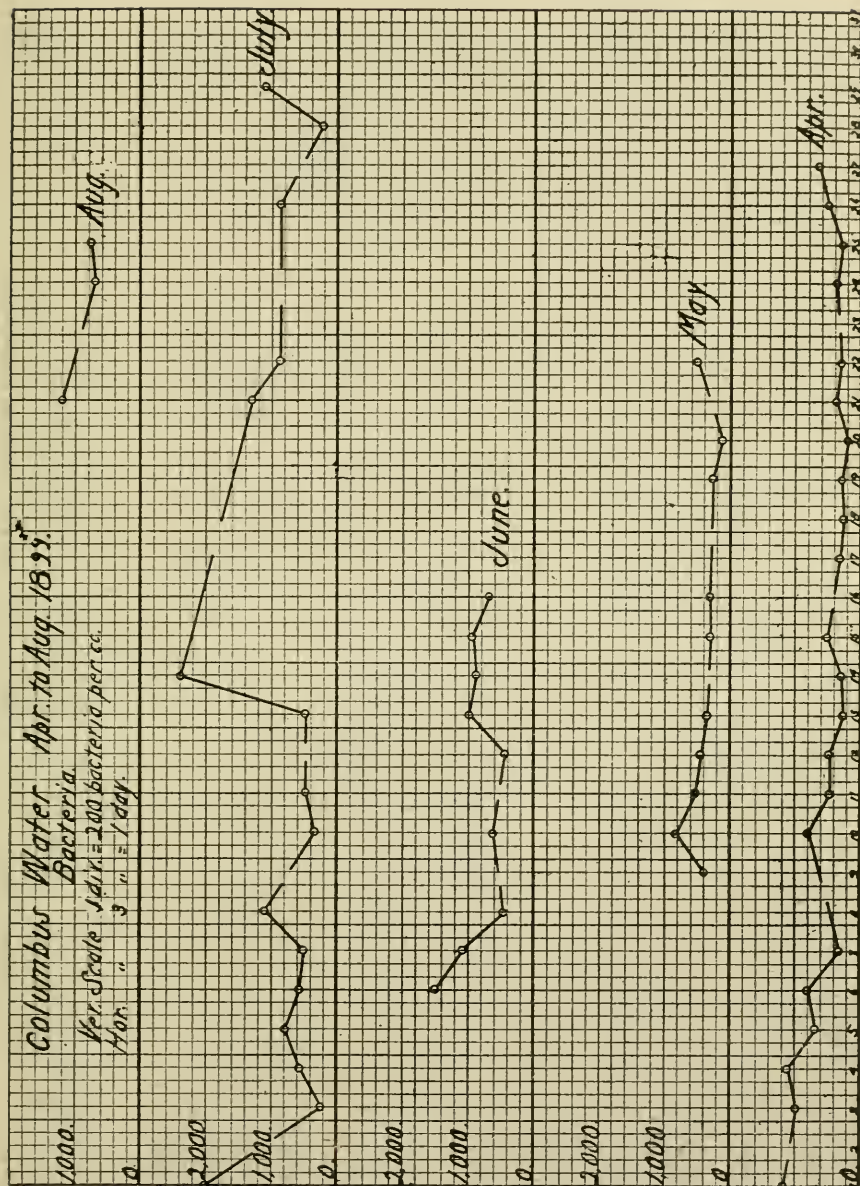
174 samples taken on 174 days with 174 quantitative bacteriological, 3 qualitative bacteriological, and 7 chemical examinations.

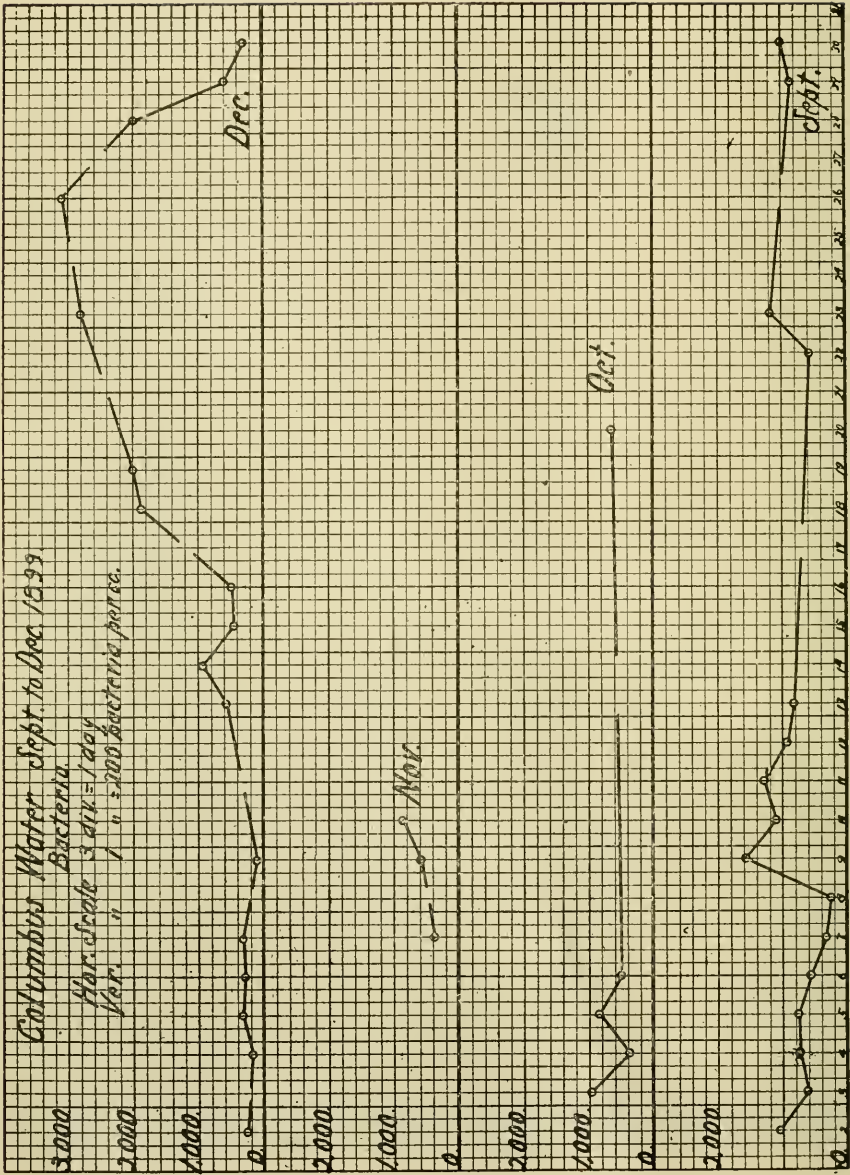
The number of bacteria in the Columbus water on the days examined is also shown in the five plates which follow:











MISCELLANEOUS WATERS EXAMINED BACTERIOLOGICALLY.

Place.	Sample Number.	Source.	Cause for Examination.	Collected.		Number Bacteria Per C. C.	Character of Bacteria.	Remarks.
				No.	Day.			
Bloomington.....	764	Private well.....	Typhoid.....	10	11	682	Colon present.....	Polluted. Ordered closed.
Columbus.....	806	"	"	10	25	38	No colon.....	Good.
Congo.....	870	"	"	12	6	4,000	Colon present.....	Condemned. Ordered closed.
"	871	Village hydrant.....	"	12	6	300	No colon.....	Usable.
"	872	School-house cistern.....	"	12	6	1,100	"	Usable if protected.
Congress Tp., Morrow Co.....	802	Private well.....	"	10	23	1,000	Suspicious.....	Not potable.
"	803	"	"	10	23	7,500	Doubtful.....	Condemned.
"	804	"	"	10	23	1,082	Not satisfactory.....	Second sample requested.
"	805	"	"	10	23	2,928	"	"
Conneaut.....	720	Cistern.....	"	9	22	4	No colon.....	Excellent.
"	721	Effluent private filter.....	"	9	22	12,000	Colon present.....	Condemned. See page 78.
"	722	Fire hydrant.....	"	9	22	1,650	Suspicious.....	Advised closing.
"	723	Private well.....	"	9	22	10,810	Colon present.....	"
"	715	"	"	10	3	133	"	Condemned. See page 79.
"	748	Lake, pumping station.....	"	10	4	173	No colon.....	Usable.
"	750	Private well.....	"	10	4	1,012	Suspicious.....	Usable.
"	749	"	"	10	4	113	No colon.....	Usable.
Cuyahoga Falls.....	674	"	"	10	4	1,363	Colon present.....	Condemned. Ordered closed.
"	675	"	"	9	4	1,446	"	"
"	753	"	"	9	5	2,426	Putrefactive.....	Suspicious.
"	754	"	"	10	4	2,614	"	"
"	780	"	"	10	12	6,175	Colon present.....	Polluted. Ordered closed.
Girard.....	814	"	"	11	6	880	No colon.....	Usable.
Goodwin.....	367	"	"	3	24	38,470	Colon present.....	Polluted. Ordered closed.
Grover Hill.....	313	"	"	61	28	4,800	Putrefactive.....	Not cause typhoid.
Hubbard.....	623	Well.....	Quality Typhoid.....	8	23	173	No colon.....	Safely usable.
"	624	Private well.....	"	8	23	979	"	Advised temporary abandoning.
"	625	"	"	8	23	1,833	Suspicious.....	"
"	626	"	"	8	23	2,000	Colon present.....	Polluted. Ordered closed.
Hunter.....	793	"	"	10	19	26,450	Suspicious.....	"
"	794	"	"	10	19	2,146	"	"
"	795	"	"	10	19	1,492	"	"
Lakeside.....	634 (1)	Filter test.....	See page 221	93	9	7,667	Putrefactive.....	Suspicious. Advised boiling of water.
"	446	Private well.....	Influence of ditch	93	9	151,200	"	Polluted.
Leipsic.....	330	"	"	93	9	151,200	"	"
"	340	"	"	93	9	115,170	"	"
"	311	Ditch.....	"	93	9	15,915	"	"
"	312	"	"	93	9	8,265	No colon.....	Not potable.
"	343	Private well.....	"	93	9	68,800	Putrefactive.....	Polluted.
"	344	"	"	93	9	1,800	Colon present.....	Ordered closed.
Londonville.....	812	Ditch.....	"	11	6	2,090	"	"
"	813	Private well.....	Typhoid.....	11	6		"	"

* Received Collection date not stated to us.

MISCELLANEOUS WATERS EXAMINED BACTERIOLOGICALLY—Concluded.

Place.	Sample Number.	Source.	Cause for Examination.	Collected.		Number Bacteria Per C.C.	Character of Bacteria.	Remarks.
				Mo.	Day.			
Lowell.	771	Private well.	Typhoid	10	12	910	Suspicious	Advised closing.
Malinta.	700	"	"	9	18	530	Colon present.	"
Marietta.	536	Public well	Quality	9	19	492	No colon	"
"	537	"	"	7	13	200	"	"
"	538	"	Typhoid	7	13	190	Putrefactive	"
"	539	"	"	7	13	2,775	"	"
Mingo Junction.	737	Hydrant	"	7	13	267	Unsatisfactory	Second sample requested.
"	798	"	"	10	20	+	"	"
"	799	Spring	"	10	13	+	Suspicious	Condenned
Painesville.	815	College well.	Quality	10	13	+	Unsatisfactory	Second sample requested.
Radnor.	816	City water	Quality	11	6	39	No colon	Good.
"	681	Township well	Quality	11	6	14	"	"
"	682	Private well.	Typhoid	9	6	179	"	Usable.
"	683	"	"	9	6	2	"	Excellent.
Reading.	684	Cistern.	"	9	6	185	Colon present.	Polluted. Ordered closed.
Sufield.	661	Private well.	"	9	6	35	Suspicious	Suspicious. Advised boiling water.
"	662	"	"	10	16	1,296	No colon	Advised protection and cleaning.
Tiffin.	679	Public	"	8	31	+	Suspicious	Second sample requested.
Tiro.	762	Private	Quality	9	5	148	"	Advised cleaning of well.
"	647	Town	Typhoid	10	10	1,316	No colon	Suspicious.
"	618	Private	Quality	6	28	571	Colon present	Polluted. Ordered closed.
"	619	Stream	Typhoid	8	28	632	Suspicious.	Advised boiling water.
"	650	Private well.	"	8	28	378	Colon present.	Polluted. Ordered closed.
Troy.	685	"	Bowel trouble	9	5	1,612	"	"
"	686	"	Typhoid	9	6	1,556	Suspicious	Advised cleaning well and boiling
Wrightsv.	709	"	"	9	20	2,180	Colon present.	Polluted. Ordered closed.

* Received. Collection date not stated to us.

† Samples not collected in sterile bottles, number of bacteria undetermined.

a. The colon bacillus is a native of the intestines, and its presence in a water is generally taken to mean that intestinal material has reached that water. If a water is receiving intestinal discharges it cannot be considered a safe drinking water as a single typhoid stool entering it might lead to a typhoid epidemic. Now since colon bacilli are always present in intestinal discharges, and typhoid germs only in typhoid cases, it is customary, in making bacteriological examinations of suspected waters, to search for the presence of the colon bacillus and not for the bacillus of typhoid as some suppose is done. A water may be receiving gross pollution and yet a given sample might not contain a typhoid germ, but it would hardly be free from colon bacilli.

b. In passing judgment upon the quality of a water, the opinion was not formed alone from a consideration of the analysis, but we also consider the cases of illness among the people using the water, and again the data contained in the information blank required to be filled out for each sample of water. See Report of the State Board of Health of Ohio, 1898, p, 50.

CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF MISCELLANEOUS WATERS.

Place.	Sample Number.	Source of Sample.	Cause for Examination.	Date Collected.		Color.	Turbidity.	Sediment.	Odor.	Oxygen Required.
				Month.	Day.					
Archbold	419	Well	Typhoid	5	15	10	None...	None...	None...	1.69
"	420	Public well.	"	5	15	10	"	V. S.	Faint sour.	1.61
"	431	"	"	5	15	10	Trace...	None...	Faint earthy.	1.44
Armstrong Mills.	432	"	"	5	15	20	"	V. S.	"	2.25
"	433	Private well.	"	95	9	20	X	X	Vinegar	3.06
"	434	"	"	95	9	10	"	"	"	1.23
Canal Dover	425	Wells, public supply.	Quality	5	5	10	None...	None...	"	1.49
Conneaut	718	Conneaut river.	Typhoid	9	22	21	V. S.	S	"	2.63
"	719	"	"	9	22	13	Dis	S	Faint musty.	2.76
"	723	Lake Erie	"	10	3	10	S	V. S.	None...	2.11
"	744	Intake, Lake Erie.	"	10	3	10	S	S	"	2.78
Eucled Village.	691	Spring No. 1.	Polluted(?)	69	11	15	V. S.	Trace...	Sulphur	7.97
"	692	" 2.	"	69	11	10	Trace...	None...	None...	1.29
"	800	" 1.	"	11	28	10	None...	Trace...	Faint sulphur.	2.70
"	801	" 2.	"	11	28	Trace	Trace...	"	None...	3.30
Findlay	801	Private well	Typhoid	6	13	10	None...	"	"	3.38
"	905	"	"	6	13	75	Dec...	S	Faint musty.	20.17
Greenville	361	City main.	Quality and deposit.	3	30	20	S	S	Chalky	33
"	362	Waterworks wells.	"	3	30	20	S	S	"	30
Hicksville	685	"	Complaints	3	20	20	Trace...	Trace...	Hydrogen sulphide.	28.06
Killbuck	847	Spring	Typhoid	3	17	20	None...	Trace...	Sweetish	2.64
Lakeside	601	See page 221.	Filter test	11	18	Trace	None...	"	"	"
"	602	"	"	"	"	"	"	"	"	"
Leipsie.	350	Private well.	Influence of ditch.	93	13	10	None...	None...	Earthy	4.37
"	351	"	"	93	13	40	Dec...	C	Peenfar	13.48
"	352	Ditch	"	93	13	55	"	C	Musty	10.01
"	353	"	"	93	13	45	"	C	"	"
"	801	Waterworks wells.	Efficiency	10	23	55	None...	None...	Very musty	10.89
Lima	416	Effluent of Reformatory filter beds.	"	5	4	35	V. S.	S	Oil and gas.	1.89
Mansfield	175	Dug well, waterworks.	Quality	5	29	50	Trace	Trace	Musty	8.54
Massillon	445	Drilled well, waterworks.	"	5	12	15	None...	None...	"	5.87
"	446	"	"	5	12	15	Trace...	C	None...	79
Marietta	464	Ohio river at intake.	"	5	12	15	Trace...	C	Faint musty.	48
"	512	"	"	5	24	20	1.30	S	"	25.75
"	587	"	Quality at request of Board of Health.	6	25	15	.08	S	"	3.69
"	600	"	"	7	22	15	.45	C	Musty	4.14
"	660	"	"	8	25	13	.11	S	Faint musty.	3.33
"	731	"	"	9	27	22	.12	S	Vegetative	3.31

Place.	Sample Number.	Nitrogen as			Chlorine.	Alkalinity.	Incrusting Constituents.	Total Solids.	Loss of Ignition.	Colon Bacilli Present.	Bacteria Per C. C.	Remarks.
		Albuminoid Ammonia.	Free Ammonia.	Nitrites.	Nitrates.							
Archbold	449	.055	.011	.003	.214	106.0	432.0	939	182	X	X	Advised protection of well. Usable.
"	450	.066	.308	Trace	.03	189.8	325.2	770	141	X	X	"
"	451	.054	.292	"	None	223.0	314.8	781	136	X	X	Advised to close well. Condemned. Ordered closing.
Armstrong Mills.	452	.105	.018	"	.13	101.2	313.2	593	124	X	X	Suspicious. Advised closing. Excellent.
"	433	.088	.033	.030	6.82	42.7	X	X	X	Yes.	X	Putrefactive.
"	434	.034	.006	.006	8.27	19.3	X	X	X	Putrefactive.	X	"
Canal Dover	425	.026	.021	None	.03	2.5	184.2	334	51	X	X	"
Conneaut	718	.140	.007	.004	.04	4.9	92.6	253	90	Yes.	513	Public supply condemned. Filters were installed by Water Company. See page 92.
"	719	.105	.052	.026	.05	5.3	101.4	179	70	Yes.	1,155	"
"	743	.099	.002	.009	.06	4.8	96.2	42	61	Susp.	238	"
"	714	.102	.002	.008	.04	5.2	98.0	164	57	X	95	"
Enclid Village	691	.404	.110	Trace	.11	54.0	111.8	770	163	X	X	Polluted.
"	692	.044	.046	.032	Trace	14.0	80.6	700	135	X	X	Suspicious.
"	860	.103	.706	.010	.02	21.7	135.0	738	140	X	X	Polluted.
"	861	.034	.010	None	None	9.4	80.4	711	131	X	X	Usable.
Findlay	504	.102	.034	.048	13.60	62.5	316.9	789	277	Yes.	60,320	Polluted. Ordered closing.
"	505	.722	.036	.008	50.66	297.9	470.5	2972	1010	No	1,364	"
Greenville	361	.021	.196	Trace	.09	2.4	362.4	486	96	X	X	Usable.
"	362	.020	.186	None	.08	2.4	361.4	474	93	X	X	Undesirable.
Hicksville	695	.020	.438	Trace	Trace	79.8	254.4	3392	775	X	25,500	Suspicious. Collection not satisfactory.
Killbuck	847	.060	.004	.018	1.21	17.3	X	X	X	X	X	"
Lakeside	691											"
Leipsic	692											"
"	350	.160	.028	.010	.876	114.5	370.6	734	132	X	X	Polluted.
"	351	.328	.140	.030	24.63	40.0	118.4	669	118	X	X	"
"	352	.456	.101	.008	8.96	6.1	108.6	279	57	X	X	"
"	353	.706	.108	.055	9.33	16.6	121.7	336	94	X	X	"
"	801	.070	.308	None	None	97.1	345.6	1313	385	X	X	An unsatisfactory water.
Lima	416	.561	.4750	.112	11.11	92.0	79.2	513	176	X	5,000	Purification not complete.
Mansfield	475	.287	1.700	.190	22.98	65.3	20.3	567	269	X	4,900	"
"	476	.080	.000	.000	.000	24.3	106.2	592	114	X	X	Usable.
Massillon	445	.017	.010	Trace	.05	21.3	102.3	291	89	X	X	Good.
"	446	.013	.006	.003	.04	13.3	54.4	799	59	X	1,000	"
"	447	.014	.006	.003	.04	13.3	54.4	799	59	X	1,000	"
Marietta	512	.248	.172	.002	.28	16.8	18.0	147	47	X	500	"
"	587	.206	.022	.002	.07	20.8	23.4	247	88	X	1,100	"
"	660	.134	.038	.002	.08	34.8	91.1	247	82	X	4,600	Not a wholly satisfactory water
"	731	.142	.020	.005	.10	39.9	41.4	238	81	X	220	"

CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF MISCELLANEOUS WATERS—Continued.

Place.	Sample Number.	Source of Sample.	Cause for Examination.	Date Collected.		Color.	Turbidity.	Sediment.	Odor.	Oxygen Required.
				Month.	Day.					
Marietta	786	Ohio river at intake	Quality at request of Board of Health.	10	17	20	.06	V. S.	Faint musty	2.49
.....	823	Hydrant	Complaints	11	22	40	.30	C.	Earthy	6.14
Nelsonville	989	Public well	Bowel trouble	1	23	40	None	None	None .....	.67
New Vienna	376	.....	Quality	4	3	15	None	Much	Disagreeable	14.39
"	322	.....	.....	6	27	10	None	V. S.	None	3.11
"	323	Artesian well .....	.....	6	27	10	None	"	None	2.21
"	631	School well .....	.....	8	23	15	S.	S.	Earthy	7.83
Norwalk	532	Lower reservoir	Odor and taste	12	12	23	V. S.	V. S.	Vegetative	7.35
"	533	.....	" .....	12	12	35	"	"	"	6.00
"	534	Upper	"	12	12	30	"	"	Hydrogen sulphide	12.78
"	535	Yard hydrant	"	11	9	Trace	None	None	None	7.76
Painesville	822	College well	Continued fever	9	27	25	V. S.	None	Slight sulphur .....	.82
Shelby	527	Waterworks wells	Consumers' complaints	11	25	25	Trace	S.	Musty	1.70
Tiffin	588	Sandusky river below Morrison creek	River pollution	12	25	25	Trace	S.	"	6.80
"	589	"	"	12	25	3.00	Disc.	"	"	5.80
"	590	Strawboard reservoir	Quality	8	29	15	None	None	Foul	727.30
"	638	Tap city supply	Typhoid?	8	31	13	X	None	Peculiar	2.98
"	639	Private well	Polished?	5	3	30	S.	X	Sweetish	2.26
Tippecanoe City	432	Ice pit well	Typhoid	10	8	Trace	S.	"	Vegetative	7.68
.....	747	Hydrant at hotel	Quality	7	20	20	12	V. S.	None	1.37
Uhrichsville	578	Waterworks, large well	Suspected pollution at request of committee on water.	5	10	None	None	None	Earthy	3.81
Urbana	438	Reservoir	"	5	10	"	"	"	" .....	.52
"	439	Dead end city main	"	5	10	"	"	"	"	2.18
"	440	Livestock well	"	5	10	"	"	"	" .....	.60
"	441	Private well	"	5	10	30	"	"	" .....	.63
"	442	Spring	"	5	10	Trace	"	S.	Sour	3.80
Wadsworth	627	Yard hydrant	Suspected pollution at request of Board of Health.	8	23	10	V. S.	None	None	1.01
"	628	"	Quality	8	23	Trace	None	V. S.	Faint .....	.77
"	630	Spring	"	8	23	10	None	Trace	"	1.18
"	630	Pumping station tap	"	8	23	10	S.	"	Earthy .....	.78
Warren	273	Park well	Quality	31	28	None	None	S.	None	1.40
"	307	"	"	34	16	27	V. S.	V. S.	"	1.62
"	307	"	"	6	16	27	V. S.	"	Peculiar	3.29
Weston	372	Public well	Bowel trouble	3	28	.10	None	Trace	Faint earthy	3.90

CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF MISCELLANEOUS WATERS — Concluded.

Place.	Sample Number.	Nitrogen as			Chlorine.	Alkalinity.	Incrustings.	Total Solids.	Loss of Ignition.	Colon Bacilli Present.	Bacteria Per C. C.	Remarks.
		Albuminoid Ammonia.	Free Ammonia.	Nitrites.	Nitrates.							
Marietta	785	251	.006	.010	.13	62.0	50.2	323	89	X	55	} Not a wholly satisfactory water. Good. Condemned. Ordered closed. Good. Unsatisfactory.
"	853	157	.002	.004	.17	46.2	41.0	411	91	X	3,900	
Nelsonville	280	.080	.020	.001	.31	7.3	113.2	647	136	X	X	
New Vienna	376	.078	.016	None	31.16	130.2	214.1	1248	563	X	X	
"	523	.070	.770	None	Trace	12.3	None	299	112	X	X	} See full report on page 123. Good. Unsatisfactory.
"	523	.070	.770	None	Trace	8.1	None	252	92	X	X	
"	631	.163	.1570	.010	"	4.2	"	464	154	X	X	
Norwalk	552	.178	.254	.010	.04	9	1.4	169	60	X	375	
"	553	.190	.220	.044	.04	9	4.0	181	77	X	463	} See full report on page 123. Good. Unsatisfactory.
"	554	.420	.348	.001	Trace	7	None	213	81	X	1,032	
"	555	.154	.348	.001	Trace	7	None	167	62	X	X	
Painesville	822	.028	.003	None	"	4.8	31.8	166	36	X	X	
Shelby	527	.106	.314	Trace	.03	11.5	103.4	601	179	X	10	} But slight influence, as very little straw-board material was being introduced. A foul liquid. An unsatisfactory water. Polluted. Ordered closed. Advised condemning and closing. Not wholly satisfactory.
Tiffin	588	.382	.092	.010	.16	230.4	162.8	928	302	X	X	
"	589	.396	.240	.009	.11	222.8	147.8	953	317	X	X	
"	590	.2950	.290	...	.82 (2)	40.2	26.8	3300	2900	X	X
"	658	.196	.086	.024	.12	70.6	88.0	591	188	X	X	} See full report on page 132. Good. Usable. Advised condemning and closing. Not wholly satisfactory.
"	669	.130	.296	.024	8.70	57.8	X	X	X	Yes	X	
Tippecanoe City	432	.378	.071	.012	.10	2.8	19.6	375	108	X	X	
"	747	.054	.040	.010	.09	4.7	None	425	132	X	X	
Urichsville	578	.153	.002	.003	.03	1.6	32.8	297	67	X	275	} See full report on page 132. Good. Usable. Advised protection. Good. Not satisfactory. Undesirable. Very undesirable. Advised abandoning.
Urbana	438	.011	.001	None	4.44	7.2	None	474	126	X	X	
"	439	.103	.017	.041	3.75	6.4	7.2	416	48	X	X	
"	440	.034	.011	Trace	4.29	6.5	256.4	424	136	X	X	
"	441	.038	.011	Trace	4.33	6.9	255.6	434	120	X	X	} See full report on page 132. Good. Usable. Advised protection. Good. Not satisfactory. Undesirable. Very undesirable. Advised abandoning.
"	442	.153	.057	.001	.16	11.7	286.2	391	113	X	X	
Wadsworth	627	.035	.006	Trace	.34	2.4	10.6	95	35	X	X	
"	628	.023	.006	Trace	Trace	10.3	54.4	289	72	X	X	
"	629	.025	.009	.001	.26	7.0	36.8	100	34	X	X	} See full report on page 132. Good. Usable. Advised protection. Good. Not satisfactory. Undesirable. Very undesirable. Advised abandoning.
"	630	.011	.001	Trace	Trace	11.3	18.2	250	64	X	X	
Warren	273	.108	.250	.001	.16	160.2	84.6	1975	312	X	X	
"	390	.060	.292	.002	.17	478.4	190.8	1915	402	X	X	
"	503	.137	.634	None	.05	768.0	None	2072	349	X	X	} See full report on page 132. Good. Usable. Advised protection. Good. Not satisfactory. Undesirable. Very undesirable. Advised abandoning.
Weston	372	.156	Trace	.006	5.49	91.8	328.3	2993	661	X	X	

Abbreviations used: S, slight; V. S., very slight; Dis., distinct; Dec., decided X, undetermined. * Date received; collection date not given.

MINERAL EXAMINATIONS.

Mineral examinations were made of four of the above samples with the following results:

Number	361	860	861	273
Determination	Greenville	Euclid village	Euclid village	Warren
Silica	5.2	11.0	15.4	×
Oxides of Fe and Al.....	9.7	15.4	30.4	×
Sulphuric Acid (SO ₃).....	16.4	288.7	324.9	639.7
Calcium	95.5	66.9	60.5	149.2
Magnesium	28.8	25.7	40.8	32.9
Chlorine	2.4	21.7	9.4	160.2
Phosphates	×	trace	none	×
Lead	×	none	none	×
Barium	×	none	none	×
Copper	×	none	none	×
Zinc	×	none	none	×
Manganese	×	none	none	×
Sodium	present	present	present	present

The results obtained from the 238 samples of the year's river work will be found elsewhere under the head "Report of the Muskingum River and Tributaries."

PROPOSED PUBLIC WATER SUPPLIES.

In connection with proposed public water supplies and additions to present supplies, examinations have been made of samples of water from the seventeen places named below. In order to prevent repetition, the results of the analyses are here omitted, as they may be found under the name of the city or village in the portion of this volume headed "Reports of Proposed Public Supplies." Since the report of the State Board of Health is required for the year ending October 31, and the laboratory report in conformity with those for vital statistics and local boards is for the calendar year, those of the following proposed supplies acted upon after October will appear in the report for 1900.

Place.	Source of Samples.	No. of Samples
Batavia	River	1
Berea	River, Quarry, Well.....	3
Cambridge	Wells	6
Cambridge	Creek	1
Canton	Well	1
Coshocton	Wells	2
Glouster	Mines	2
Greenville	Well	1
Jackson	Mines	3
Jackson	Well	1
Kenton	Well	2
Massillon	Well	1
McConnellsville	Wells	3
Piqua	Wells	6
Sebring	Well	1
Shreve	Spring	1
Troy	Wells	2
Youngstown	Creeks	6
Youngstown	River	2
Zanesville	Well	4
Total samples.....	.....	49

SUMMARY OF LABORATORY WORK.

There have been received 654 samples of all kinds divided as follows: Diphtheria, 14; typhoid blood, 3; tuberculosis, 1; miscellaneous, 23; Columbus water, 174; miscellaneous waters, 152; proposed or additional public water supplies, 49; river work, 238. These 654 samples received 1293 examinations as follows: 680 bacteriological, 366 chemical, 4 mineral, 5 biological, and 238 dissolved oxygen.

LIST OF
CITIES AND VILLAGES
HAVING
BOARDS OF HEALTH.
WITH NAME OF
HEALTH OFFICER.

MAY 18, 1900.

HEALTH OFFICERS.

CITIES.

Akron	Dr. E. S. Underwood.
Alliance	Dr. P. W. Welker.
Bellaire	Dr. D. W. Boone.
Bucyrus	Dr. W. A. Daugherty.
Canton	Dr. J. F. Marchand.
Chillicothe	Dr. J. M. Hanley.
Cincinnati	Dr. Clark W. Davis.
Circleville	Mr. John L. Cummins.
Cleveland	Dr. Geo. F. Leick.
Columbus	Dr. W. D. Deuschle.
Dayton	Dr. C. W. King.
Defiance	Dr. E. E. K. Chapman
Delaware	Dr. D. E. Hughs.
East Liverpool	Dr. C. B. Ogden.
Fremont	Dr. O. H. Thomas.
Findlay	Mr. Amos Beardsley.
Fostoria	Mr. W. N. Caldwell.
Galion	Dr. H. H. Hartman.
Gallipolis	Dr. James Johnston.
Greenville	Dr. John D. Kerlin.
Hamilton	Dr. A. L. Smedley.
Ironton	Dr. E. E. Wells.
Kenton	Mr. F. H. Fall.
Lancaster	Dr. F. P. Stukey.
Lima	Dr. L. F. Laudick.
Mansfield	Dr. J. Harvey Craig.
Marietta	Dr. J. B. McClure.
Massillon	Dr. T. Clarke Miller.
Martins Ferry	Dr. A. R. Ong.
Marion	Mr. G. W. Blain.
Middletown	Dr. Geo. D. Lummis.
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Newark	Dr. D. M. Smith.
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Portsmouth	Mr. Peter S. Revare.
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Wellston	Mr. Thos. Wilson.
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Alvordton	Dr. T. E. Schrider.
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Ashley	Dr. H. N. Coomer.
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Chagrin Falls	Mr. I. N. Warner.
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Dillonvale	Dr. C. W. Mercer.
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Harrisville	Dr. G. H. Colvill.
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Jackson	Mr. Henry Simpson.
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Jeffersonville	Dr. D. H. Rowe.
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Lodi	Mr. Henry Selden.
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Milan	Mr. Richard Rawl.
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Mingo Junction	Mr. F. S. Buchanan.
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Reynoldsburg	Dr. F. G. Taylor.
Richmond	Dr. Samuel Rothacker.
Richwood	Mr. F. L. Berry.
Ridgeway	Dr. E. B. Crow.
Ripley	Dr. G. M. Robb.
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South Charleston	Dr. C. A. Grahn.
South Lebanon	Dr. S. Lambright.
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St. Clairsville	Dr. D. L. Walker.
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Swanton	Dr. W. A. Scott.
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West Cairo	Dr. Geo. W. Henderson.
West Carrollton	Mr. James B. Manly.
West Elkton	Dr. Elwood Holaday.
Westerville	Mr. James D. Budd.
Western Star	Mr. P. A. Johnson.
West Jefferson	Mr. W. R. Borland.
West Leipsic	Mr. M. L. Pritchard.
West Liberty	Dr. R. M. Fulwider.
West Manchester	Mr. David E. Allen.
West Mansfield	Dr. J. W. Arbegast.
West Milton	Dr. Gainor Jennings.
West Salem	Dr. D. W. Carver.
Weston	Dr. G. B. Spencer.
West Union	Dr. W. K. Coleman.
West Unity	Mr. J. H. Tiddler.
White House	Mr. W. K. Jones.
Wilkesville	Dr. E. M. Dixon.
Williamsburg	Dr. Isaac Redrow.
Williamsport	Dr. G. C. Hayes.
Windham	Mr. H. J. Higby.
Willoughby	Dr. Geo. B. Durban.
Willshire	Dr. J. F. Schaffner.
Wilmington	Dr. A. T. Quinn.
Wilmot	Mr. John F. Thompson, Secretary.
Winchester	Mr. Alfred Johnson.
Winton Place	Mr. G. C. Wildman.
Woodsfield	Mr. A. S. Baker.
Woodstock	Mr. Oliver Ewing.
Woodville	Mr. F. L. Nieman.
Worthington	Dr. D. H. Welling.
Wyoming	Mr. Geo. Stoddard.
Yellow Springs	Dr. W. M. Haffner.
Zanesfield	Dr. C. M. Wanzer.
Zoar	Mr. C. F. Sylvan.

ANNUAL REPORTS
OF
LOCAL BOARDS OF HEALTH
FOR THE
YEAR ENDING DECEMBER 31, 1899.

ANNUAL REPORTS OF LOCAL BOARDS OF HEALTH.

OHIO STATE BOARD OF HEALTH.

OFFICE OF THE SECRETARY.

COLUMBUS, OHIO, December 31, 1899.

To the Health Officer:

DEAR SIR:—Will you please furnish the State Board of Health with a report of the operations of your board of health during the year ending December 31, 1899?

Kindly use the blank space following for your report, being as brief as clear statements will allow.

We wish to know particularly the present sanitary condition of your city or village, and whether your board has maintained an active organization and been successful in enforcing proper measures for the prevention of contagious disease and the abatement of nuisances.

The following points are suggested:

Sanitary Condition.—Are streets, alleys and yards in a cleanly condition? Is there cause for complaint from the lack of sewerage, or from an improper discharge of sewage? Are there nuisances which the board has unsuccessfully tried to abate? If so, what is their nature? What arrangements are made for the removal and disposition of night soil and garbage?

Contagious Diseases.—Are contagious diseases properly reported? Is a record of such diseases kept? Has the board been able to enforce proper restrictive measures? What contagious diseases have been more prevalent than usual? Give estimated number of persons vaccinated during the year? Please ascertain from superintendent of schools, if possible, and state the number of unvaccinated children attending public and parochial schools.

The Board of Health.—How many meetings has the board of health held during the year? Give total amount spent by board of health for the year. Give the number, character and results of any prosecutions brought by the board of health for violations of its orders or of health laws. Have you any suggestions to offer for improving the form or character of our present health boards?

Please return your report at the earliest possible time, in order that it may be included in the next annual report of the State Board of Health.

Very respectfully,

C. O. PROBST, M. D.,

By order of the Board.

Secretary.

ANNUAL REPORTS OF LOCAL BOARDS OF HEALTH.

ABERDEEN, BROWN COUNTY.

T. Heaton, health officer.

Population (estimated), 900.

The sanitary condition good. Board of health has not maintained an active organization. It meets about twice in the year.

With few exceptions the premises are kept in good condition. The board of health has not spent any money. The sanitary policeman is paid by the village council.

I have not succeeded in obtaining reports from the other physicians of the village, therefore make this report from my own knowledge.

Infectious diseases reported during the year: Typhoid fever, 12 cases; measles, 10 cases.

ADA, HARDIN COUNTY.

W. H. Morrow, health officer.

Population (estimated), 3,000.

Our board has an active organization. All contagious and infectious diseases promptly reported, and orders of board fully respected.

We have had no epidemic the past year and everything is fully satisfactory.

We have had no vaccinations of children. During the year our board has held six meetings.

Expense \$40.00, total of board.

We have had no violations or prosecutions during the year.

Infectious diseases reported during the year: Scarlet fever, 9 cases; typhoid fever, 6 cases.

ADDYSTON, HAMILTON COUNTY.

Hugh Kennedy, health officer.

Population (estimated), 1500.

We have a very good health board here at present with Mayor Charles

Glover at the head of it. It meets once per month and I think things are as cleanly here as any other place of its size, as one-half of the population are negroes and they are not the cleanest people in the world. The street car company is working here now and things are more topsy turvy than they would be but they expect to have it in running order by the 1st of May which will make things better all around.

We are in hopes the smallpox has given us the go by. God grant it may be so, but during its prevalence here I think this board did all in its power to stamp the disease out.

We have a very good school building here with plenty of egress for escape in case of fire. The children were all vaccinated during the smallpox scare.

The property here generally all belongs to Building Associations and we have a little trouble in regard to cleaning out vaults, but have not had recourse to law as yet. The salary of the health officer is \$60 per year and the clerk's I believe is \$30 per year.

Expense for last year \$13.00, but of course it was the smallpox that brought it so high.

We are clear of contagious diseases at present.

Infectious diseases reported during the year: Smallpox, 9 cases; whooping cough, 1 case; measles, 7 cases.

ADELPHI, ROSS COUNTY.

W. S. Koch, health officer.

Population (estimated), 650.

In answer to your questions, I will state that our board of health was but recently organized, and we have had but one case of contagious disease so far. We had a case of scarlet fever which was very light and we took that in charge in time to prevent any spread and are now clear.

Our streets and alleys are in a very fair condition. We are on the lookout for any contagious diseases that we may be exposed to.

I find that a very small per cent. of the children are vaccinated.

No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 1 case.

AGOSTA, MARION COUNTY.

Wm. Carey, health officer.

Population (estimated), 500.

The board of health meets every month and has been able to abate all nuisances that have been reported. We expended about \$50 last year. Our streets and sewerage are in fair condition or will be after we get through work next month.

Our wells are all drilled to 80 and 100 feet.

Night soil is left in the pits.

All contagious diseases are quarantined.

Infectious diseases reported during the year: Diphtheria, 4 cases; typhoid fever, 2 cases; whooping cough, 8 cases.

ALGER, HARDIN COUNTY.

Dr. R. F. Coppess, health officer.

Population (estimated), 500.

We had trouble here with the trustees of the township in regard to some families that the town quarantined, about giving them relief which caused confusion with the board of health and they have not had any meetings since spring.

Our sanitary condition is better than a year ago but could be better.

ALLIANCE, STARK COUNTY.

P. W. Welker, M. D., health officer.

Population (estimated), 10,000.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 19 cases.

APPLE CREEK, WAYNE COUNTY.

W. H. Winkler, health officer.

Population (estimated), 500.

Streets and yards in good condition. Alleys not so good. Too much rubbish and manure thrown in alleys. Complaint is made against two privies which are built below (25 feet and 40 feet) a flowing fountain of water; and the contents of privies washed into the creek. No particular arrangements for disposing of night soil or garbage.

Contagious diseases are reported. No record kept. The board has no trouble to enforce restriction. Some diphtheria. Number vaccinated, about 35.

Number of meetings, about 6. Spent about \$25.00. No prosecutions.

ARCANUM, DARKE COUNTY.

E. B. Hawley, health officer.

Population (estimated), 1,600.

Sanitary condition of our village is good, but I think there is room for improvement. We have maintained an organization throughout the year. Had five meetings during the year, and have been successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances.

The streets and alleys are quite clean. There is no cause for complaint. The sewerage is very good.

We have a man that removes night soil and he is fully equipped for the business.

Contagious diseases are properly reported and a record is kept of the same.

I expect there were about 25 persons vaccinated during the year. Most all children that attend school are vaccinated.

Spent by board during year, \$41.25.

I think we have been very successful in every respect.

Infectious diseases reported during the year: Diphtheria, 2 cases; Membranous croup, 9 cases; scarlet fever, 1 case; typhoid fever, 4 cases; whooping cough, 50 cases; measles, 3 cases.

ARCHBOLD, FULTON COUNTY.

August Ruibley, health officer.

Population (estimated), 1,000

Our streets and alleys are in very fair condition. Our sewerage is quite good, the outlet of same should be extended. Our council made a start in the right direction by extending outlet 100 feet last summer. Our night soil is removed by a man from Wauseon and by home talent.

Our physicians are sometimes very slow in reporting contagious diseases. No vaccination reported to me during the year. A few years ago a general vaccination order was issued.

Board of health met about five times.

Expenses of board, \$30.00 for health officer's and clerk's salaries. No other expenditures.

Outside of whooping cough, which is at present epidemic in mild form, we had no contagion during last year.

A good, active board of health is hard to maintain. Why could the same not be abolished and let the council or mayor appoint a health officer. In small towns and villages this duty is the work of health officer or sanitary police could be delegated to the marshal.

 ARLINGTON, HANCOCK COUNTY.

W. D. Sebastian, health officer.

Population, 600.

Contagious diseases are properly quarantined. Nuisances are abated as soon as reported.

Total expenses of board for the year, \$16.00. Number of meetings held, 12.

 ASHLAND, ASHLAND COUNTY.

D. S. Sampsel, M. D., health officer.

Population (estimated), 5,000

The present sanitary condition of our city is fair.

Our board has maintained an active organization and has been successful in

enforcing proper measures for the prevention of contagious diseases, and the abatement of nuisances.

Our streets, alleys and yards are in a cleanly condition. We have no complaint from lack of sewerage and from an improper discharge of sewage which is into the creek running through the town.

No nuisances which the board has not successfully abated.

We have no arrangements for the removal and disposition of night soil and garbage.

Contagious diseases are all properly reported, and a record of such diseases is kept.

The board has been able to enforce proper restrictive measures. The most prevalent contagious diseases are tonsillitis and scarlet fever in the modified form.

Number of children attending public schools: 734 in attendance, 231 vaccinated. Number of persons vaccinated during the year, none.

The board of health meets the first Tuesday of each month. Amount of money spent by board of health, \$450.

No prosecutions by the board of health for violation of its orders or of health laws.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 5 cases; scarlet fever, modified form, 75 cases; typhoid fever, 6 cases; whooping cough, 15 cases; measles, 25 cases; other infectious diseases, tonsillitis, 75 cases.

 ASHLEY, DELAWARE COUNTY.

Dr. H. N. Coomer, health officer.

Population (estimated), 900.

Owing to the level location of our village the sanitary condition of the streets and alleys is sometimes neglected before complaint is made. The health officer is expected to look after and abate all nuisances. Nuisances, when properly reported, are promptly abated. Contagious diseases are prop-

erly reported and record of the same is kept.

Typhoid fever and scarlatina have been more prevalent than other contagious diseases.

We have no arrangements for the removal of night soil and garbage. A verbal order to remove the same is promptly obeyed and no prosecutions for violation of orders have been necessary.

The board of health has held twelve monthly meetings during the year, and three failures in November to attend called meetings.

The board of health consists of six members, viz., the mayor, S. Wornstaff, president; members W. Smith, Ch. Lee, W. O. Dennis, E. Coomer, A. M. Meyers and James Durkee, secretary.

Total amount spent by the board of health for the year, including \$25.00, health officer's salary, \$47.62.

The number of unvaccinated pupils attending the public schools, 173; number vaccinated, 8. I cannot ascertain that any have been vaccinated in Ashley within the year 1899.

I submit this imperfect report with the statement that most of our sanitary rules and regulations were enacted long before the 1893 and 1896 amendments of the Ohio Laws and are considered by our mayor as inoperative. I am of opinion that the rules and regulations of the Ohio State Board of Health and the laws of Ohio are a safe guide for intelligent action.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 7 cases.

ASHVILLE, PICKAWAY COUNTY.

John Johnson, health officer.

Population (estimated), 800.

No report.

ATHENS, ATHENS COUNTY.

Dr. J. L. Henry, health officer.

Population (estimated), 3,500.

The sanitary condition of the village is good.

The report of contagious diseases has been satisfactory and proper record kept. No epidemic within the past year.

It is about seven years since vaccination has been general.

The board held thirteen meetings in 1899 and expended \$250.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 4 cases.

ATTICA, SENECA COUNTY.

Dr. C. A. Force, health officer.

Population (estimated), 1,000.

The streets, alleys and yards are kept in a first class condition. Our sewerage is splendid. The board has been able to handle all nuisances successfully. Night soil is buried. Contagious diseases are reported. The board has had no trouble in enforcing its rules.

There has been no one vaccinated during the year. There are about 100 unvaccinated children attending school.

We have called meetings whenever necessary, possibly half a dozen during the year. We have not been obliged to expend any money this year as all have complied with notices.

Infectious diseases reported during the year: Scarlet fever, 2 cases; whooping cough, 4 cases.

BAINBRIDGE, ROSS COUNTY.

Dr. R. H. McKee, health officer.

Population (estimated), 1,000.

Streets and alleys are in a cleanly condition. No complaint from lack of sewerage. Board has abated all nuisances. No removal of night soil or garbage. Contagious diseases are properly reported, but no record kept. Board enforces restrictive measures.

Measles, chickenpox and whooping cough have prevailed. About 20 vaccinated. A great many not vaccinated, about 60 per cent. Board has held two meetings during the year. Expenses not over \$20. No prosecutions.

Infectious diseases reported during the year: Typhoid fever, 2 cases; whooping cough, 15 cases; measles, 10 cases.

BARBERTON, SUMMIT COUNTY.

Dr. C. H. Whipple, health officer.
Population (estimated), 4,000.

Our board has maintained an active organization and held 18 meetings during the year. Our streets, alleys and lots have not been kept clean. 1st, because of the indecision of the board as to the best methods to effect the removal of garbage. 2nd, because some of our streets and alleys are controlled by large corporations, and our board hesitates in attempting the enforcement of sanitary measures. Cannot our state law be so amended that all incorporated villages can employ a scavenger at public expense. If so it will do away with red tape necessary to compel individuals to remove their own garbage. One-fourth of the village is sewered, the remaining three-fourths is not.

The night soil is properly removed by men who are bonded to do this work right. The night soil is deposited outside the corporation.

Contagious diseases are properly reported and isolated. Diphtheria has been the most prevalent.

Number vaccinated during year very limited. Superintendent of schools reports that not over 50 per cent. of children vaccinated.

Expenses of board during year about \$400. One prosecution for violation of ordinance prohibiting keeping of swine in the village. Result, fine \$1.00 and costs and removal of nuisance.

Infectious diseases reported during the year: Diphtheria and membranous croup, 80 cases; scarlet fever, 23 cases; typhoid fever, 4 cases; measles, 8 cases.

BARNESVILLE, BELMONT COUNTY.

W. A. Talbott, health officer.
Population (estimated), 4,500.

The sanitary condition of our town is fairly good. The board of health has maintained an active organization and has been successful in enforcing sanitary and quarantine measures.

We have an ordinance regulating the removal of night soil.

Contagious diseases are properly reported excepting typhoid fever.

Number of unvaccinated children attending public schools, 545.

Infectious diseases reported during the year: Scarlet fever, 13 cases.

BARNHILL, TUSCARAWAS COUNTY.

John Stevenson, health officer.
Population (estimated) 1,200.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board of health has unsuccessfully tried to abate.

Night soil and garbage are taken outside of the corporation and buried.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce restrictive measures. Typhoid fever has been more prevalent than usual. Twelve meetings were held during the year. Amount spent, \$165.25.

Infectious diseases reported during the year: Diphtheria, 3 cases reported, but did not prove so; typhoid fever, 6 mild case; whooping cough, 17 cases.

BATESVILLE, NOBLE COUNTY.

W. K. Cooper, health officer.
Population (estimated) 400.

No report.

Infectious diseases reported during the year: Typhoid fever, 1 case.

BEAVERDAM, ALLEN COUNTY.

Dr. J. B. Haines, health officer.

Population (estimated), 400.

The sanitary condition of our village is fair. Streets and alleys being in a fair condition. Yards kept fairly well cleansed. The board of health is not active; had no meeting during the year. No prosecutions. One nuisance abated. No others attempted. No arrangements have been made for the disposition of night soil. No contagious diseases have been reported. Don't think we have had any contagious diseases in village during year.

One person has been vaccinated during year. Supt. of schools reports 96 pupils who have not been vaccinated.

BEDFORD, CUYAHOGA COUNTY.

Chas. W. Kerslake, health officer.

Population (estimated), 1,600.

The present sanitary condition of the village is good and proper measures have been taken for the prevention of contagious diseases etc. Our streets, alleys and yards are clean at present. We have no sewerage, but it would be a great help in keeping the village in a healthy condition. We had a nuisance which the board failed to abate; it was a case of failing to remove garbage, the person was willing to abate said nuisance if he had a place to dump it. I secured a dumping ground but the Council would not take any action concerning it.

As I have been the health officer since July last, I have filled out the questions asked to the best of my knowledge with information from two other health officers in the year 1899 for I am only filling out the unexpired term of J. D. Griest.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 5 cases; typhoid fever, 1 case.

BELLAIRE, BELMONT COUNTY.

Dr. D. W. Boone, health officer.

Population (estimated), 12,000.

The streets and alleys have been kept in a fair sanitary condition. The greatest trouble has been the abominable open or vault privy, but we are gradually overcoming this nuisance. While the sewerage is not A No. 1, we are making improvements and laying new sewers, as fast as the property owners will take it. There have been no nuisances that the board could not overcome.

Night soil is hauled by private parties and dumped outside of the city limits. Contagious diseases are properly reported and a record is kept. All contagious diseases are quarantined.

Typhoid fever has been reported pretty regularly and I fear that some of the doctors classify many fevers as typhoid that are not typhoid. The other contagious diseases have touched us lightly this year.

I made an effort to have the school children vaccinated but failed; offered them gratuitous vaccination, but that was no inducement. The only way we can accomplish vaccination is to have it ordered through the schools.

Six meetings of the board of health during 1899.

Expenses for the year \$200 for H. O. and \$200 for sanitary police.

One party fined for violation of health laws by letting water closet get choked and allowing water to run in the alley from same. Two cases where they refused to connect water closets to sewers and the same was done at the expense of the city and charged up as taxes to the property.

Infectious diseases reported during the year: Diphtheria, 6 cases; membranous croup, 3 cases; scarlet fever, 13 cases; typhoid fever, 108 cases; whooping cough, 71 cases; measles, 67 cases.

BELLBROOK, GREENE COUNTY.

G. H. Lamb, health officer.

No report.

BELLE CENTER, LOGAN COUNTY.

J. S. Ewing, health officer.

Population, 1,200.

Streets, alleys and yards are in fair condition. There is cause for complaint from improper sewerage. There are no nuisances which the board has unsuccessfully tried to abate. No provision is made for the disposal of night soil or garbage.

Contagious diseases are properly reported and a record is kept. The board has not been able to enforce restrictive measures. Scarlet fever has been more prevalent than usual.

Six meetings were held during the year. I have no record of amount spent. The board passes on the bills, which including health officer's salary and clerk's salary with amount spent for supplies and fumigating apparatus would not amount to over seventy dollars. The board has brought no prosecutions.

Infectious diseases reported during the year: Scarlet fever, 30 cases.

BELLVILLE, RICHLAND COUNTY.

Dr. N. R. Eastman, health officer.

Population (estimated), 1,400.

Sanitary conditions at present good.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 105 cases; typhoid fever, 7 cases; whooping cough, 12 cases; measles, 7 cases.

unsuccessfully tried to abate. Night soil and garbage are removed three miles from the city limits.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce restrictive measures. Scarlet fever has been more prevalent than usual.

The board held six meetings. Total amount spent by board \$91.50.

Infectious diseases reported during the year: Diphtheria, 19 cases; membranous croup, 2 cases; scarlet fever 16 cases; typhoid fever, 1 case.

BELMONT, BELMONT COUNTY.

David S. Pierce, health officer.

Population (estimated), 500.

Streets and alleys and all property is in good sanitary condition. No cause for complaint from sewage. Every nuisance that has been presented has been abated. Night soil is removed by the property owners, if not it is caused to be removed by health officer.

Contagious diseases are not properly reported, and no record is kept. Orders always obeyed. Whooping cough more prevalent. I know of no one being vaccinated, probably 25 not vaccinated.

No meetings of the board of health for the year 1899 nor since.

Nothing spent by the board.

No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 1 case; whooping cough, 10 cases; measles, 5 cases.

BELLEVUE, HURON AND SANDUSKY COUNTIES.

John Beattie, health officer.

Population, 4,293.

Streets, alleys and yards are in cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has

BEREA, CUYAHOGA COUNTY.

Dr. E. O. Hess, health officer.

Population (estimated), 3,500.

No report.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 1 case.

BERLIN, ERIE COUNTY.

Dr. G. W. Hine, health officer.

Population (estimated), 550.

The streets etc., are in a cleanly condition. Sewerage in some places is as good as it should be. The creamery discharges its waste alongside the road which is a cause of complaint that was tried but not abated. Night soil and garbage; there is none except to cover with dirt.

Contagious diseases are not properly reported but a record is kept. Restrictive measures. Measles more prevalent than usual. Vaccinated, none. There are in our school 150 not vaccinated.

There have been five meetings of the board. The board has expended \$25.00. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 4 cases; measles, 12 cases.

BETHEL, CLERMONT COUNTY.

Dr. Julius D. Abbott, health officer.

Population (estimated), 1000.

A good sanitary condition was maintained in our village during 1899 and is maintained at present with little exception.

The board of health is an active organization and each member is fully alive to the health interests of the town.

Our greatest trouble is with privy vaults and pig-pens, but the people are fast coming to our assistance in this matter. Privy vaults are usually on top of the ground and are cleansed several times a year and contents buried.

The health board sends printed orders to every house.

Contagious diseases in the jurisdiction of the board of health are all reported and a record of such is kept, but there seems to be no connection between the board of health of the village and the township outside the village.

By law the trustees are the board and have no one named as health officer. Doctors from adjoining townships have calls to our township and have contagious diseases to contend with but do

not report unless our trustees hear of the case and demand a report. Also the town board has no knowledge often of contagious diseases near the town line as happened last month a case of measles within fifty feet of my territory yet I knew nothing of it until it was over. Fortunately it did not spread.

Some plan should be devised by which town and township should be in accord.

A body dead from diphtheria was taken through the town for burial six months ago that died three miles in the country. We did not have knowledge of it until after the burial.

In our town the board of health has very little trouble to enforce all its orders.

We are now suffering from an epidemic of whooping cough.

But few if any persons have been vaccinated the past year. The board ordered the school children vaccinated but the school board depended on the township physician who failed to do it. This is perhaps the only failure the board of health has no record. I have no means of finding the number of unvaccinated as the whooping cough has so decimated the school.

The board meets the first Monday of each month. Our expenses are, \$25.00 for health officer, \$20.00 for clerk (both little enough surely), and our printing probably ten dollars more.

We have had no prosecutions.

No record of births and deaths is kept.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 2 cases; whooping cough, epidemic.

BLANCHESTER, CLINTON COUNTY.

Dr. N. B. Van Winkle, health officer.

Population (estimated), 2,000.

Our streets, alleys and yards are kept in good condition as a rule. Have no system of sewerage. No nuisances which have not been abated. Night soil removed after ten o'clock P. M.

Garbage removed twice a week. Contagious diseases are reported promptly and a record of same kept. Had an epidemic of measles in May and June. Very light form, no deaths. About three hundred persons vaccinated during the year. Not more than ten unvaccinated children attending the schools. Board of health has one regular meeting each month. Board has spent about one hundred dollars during the year.

No prosecutions during the year.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever 6 cases; measles, 60 cases.

BLOOM CENTRE. LOGAN COUNTY.

Dr. O. C. Wilson, health officer.

Population (estimated), 100.

No report.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 3 cases; typhoid fever, 3 cases.

BLOOMINGBURG. FAYETTE COUNTY.

L. Dellinger, health officer.

Population, 700.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has tried unsuccessfully to abate. A dump is provided for the disposition of night soil and garbage.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. The number of unvaccinated children attending the public school is 133.

The board has held five meetings during the year. \$30.00 was spent by the board during the year.

Infectious diseases reported during the year: Typhoid fever, 9 cases; whooping cough, 50 cases; measles, 1 case; chicken pox, 1 case.

BLOOMVILLE. SENECA COUNTY.

Dr. T. C. Loose, health officer.

Population (estimated), 1,000.

Our board of health has maintained an active organization.

Our alleys and streets are in a proper sanitary condition and all sewage is properly disposed of. The board has been making numerous efforts to induce council to build a stone or brick gutter on side of street in business portion of town, but have not succeeded. The gutter is in rather bad condition.

We have a regular system for the removal of night soil.

Contagious diseases are properly reported and record kept.

Scarlatina most prevalent.

Board has held four meetings. Expenditures, \$35.00.

Six vaccinations during year.

Infectious diseases reported during the year: Scarlet fever, 110 cases; measles, 25 cases.

BLUFFTON. ALLEN COUNTY.

Dr. J. F. Rudy, health officer.

Population (estimated), 2,000.

Our village is in a good sanitary condition. Have had no trouble in abating nuisances of any kind. All garbage and night soil is hauled from the corporation. We have had but very few deaths, those mostly among the aged. No deaths from any contagious or infectious diseases of any kind.

We have been blessed with health and good drainage and generally good sanitary surroundings. Expenses of board, \$25.00. No vaccinating done during last year.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 1 case; scarlet fever, 3 cases; typhoid fever, 2 cases; measles, 5 cases.

BOND HILL, HAMILTON
COUNTY.

D. Edw. Murphy, health officer.
Population (estimated), 1,200.

We can say with great pride that our village is in the best sanitary condition, and no cause for complaint.

Infectious diseases reported during the year: Diphtheria, 4 cases; whooping cough, 6 cases; measles, 20 cases.

BOWERSTON, HARRISON
COUNTY.

C. H. Siegrist, health officer.
Population (estimated), 800.

The board has held six meetings. The sanitary condition of village is good.

BOWERSVILLE, GREENE
COUNTY.

C. E. Miars, health officer.

Unable to make the required report for the year 1899, as we had some trouble here about a year ago which I referred to in my last report (of 1898). The council which we have at present have been unable to get a health board properly organized, and we have not maintained an active organization, so there has not been a record kept of the last year's work, because there has been no work done by a health board. I am heartily in favor of the proposed amendments to the health laws and am in hopes that the legislature will authorize the appointment of the commission to appoint, or classify, officers named in section 1550. I think it just the way to enforce what laws we have and the laws that should be enforced at

certain times and under certain circumstances.

Would be pleased to hear from you again if you can advise anything for our benefit.

BOWLING GREEN, WOOD
COUNTY.

A. Ordway, health officer.
Population (estimated), 6,000.

Streets and alleys in fair condition. Sewerage very bad, discharges into open ditch. Have had no trouble abating nuisances. Night soil and garbage removed to dump ground. Contagious diseases reported promptly. No vaccinations this year.

Board meets every two weeks.

There are 184 children attending school that have been vaccinated and 873 that have not been vaccinated.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 3 cases; scarlet fever, 8 cases; typhoid fever, 5 cases; measles, 4 cases.

BRADFORD, DARK AND MIAMI
COUNTIES.

John Tinkler, health officer.
Population (estimated), 1800.
No report.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 5 cases.

BRADNER, WOOD COUNTY.

F. Kirk, health officer.
Population (estimated), 1,200.

Streets, alleys and yards in healthy condition. There are no unabated nuisances, and no complaints. Garbage and night soil is removed by contract, yearly. Contagious diseases are properly reported and a record kept. The

board through its agent has been able to meet all cases. Scarlet fever has been more prevalent than usual, light form. Have no knowledge of any vaccinations during the year, have been unable to ascertain the number of unvaccinated children.

I think the board has held about one meeting during the past year. Total amount spent \$25.00, aside from salaries of H. O. and clerk \$50.00, in all \$75.00.

There have been no prosecutions for violation of laws, or any other cause.

Infectious diseases reported during the year: Membranous croup, 3 cases; scarlet fever, 25 cases; typhoid fever 2 cases.

BRIDGEPORT, BELMONT COUNTY.

Dr. C. C. Cole, health officer.

Population (estimated), 4,000.

I have got my report made out as best I can. The infectious diseases reported for the year are very incomplete, but as it has not been the custom here to report anything except the contagious diseases and the doctors seem to think it is not necessary for them to hunt up their records to give me the information. I have had some postal cards printed and I shall give each physician one to fill each month and hereafter if you like. Our present condition here as to sanitary measures is good. I have succeeded in having quite a great deal more sewerage here in the last year and also have had over 75 out-houses cleaned out which is quite a help to our sanitary conditions. I have had (5) five meetings of the health board since last May.

Vaccinations have not been very extensive not more than twenty-five during the past year.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 1 case; typhoid fever, 38 cases; whooping cough, 21 cases; measles, 11 cases.

BROOKFIELD, TRUMBULL COUNTY.

A. W. McIntosh, health officer.

Population (estimated), 750.

The sanitary condition of the village is very good. We have no sewerage. We have had no complaints. Yes, the doctors report such cases to me and when necessary we quarantine; a record of cases kept. Nothing done, law complied with whenever we notify parties. I have no way of finding out how many have been vaccinated.

The board has not held any meetings.

About \$5.00 spent during the year. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; measles, 2 cases.

BROOKLYN, CUYAHOGA COUNTY.

Wm. Treat, health officer.

Population (estimated), 1,500.

Our streets are mostly unpaved. All alleys and nearly all yards are in a cleanly condition. Surface water has given us considerable trouble. But the board of health through health officer has done considerable ditching—but more is badly needed, but lack of funds, and energy.

The village council do considerable kicking in paying bills. We have poor sewerage. But we will have better before this year closes.

No nuisances the board has been unable to abate.

A sanitary policeman removes at night, all night soil. Garbage takes care of itself—disposed of as individuals think best,—if at all.

Restrictive measures have been enforced in cases of contagious diseases.

There have been a few cases of diphtheria, scarlet fever and typhoid fever, but none of these have been especially prevalent nor fatal so far as I have observed.

Twenty persons were vaccinated during the year. 157 scholars in public

school unvaccinated, which is nearly one-half of the pupils in attendance, 49 in the parochial school, unvaccinated, and is also about one-half. More than half of these children are non-residents of this village.

The board held 18 meetings during the year.

About \$165.00 was spent..

No prosecutions have been instituted for violation of health laws.

Infectious diseases reported during the year: Typhoid fever, 10 cases; whooping cough, 1 case.

BRYAN, WILLIAMS COUNTY.

Nicholas Vineyard, health officer.

Population (estimated). 4,000.

The whole city of Bryan is kept in a cleanly condition, no complaints from any cause whatever.

255 barrels night soil removed, 60 loads of filth and debris hauled off to quarantine ground. Every symptom of contagious disease promptly reported. I keep a record of all diseases reported.

No vaccinations during the year. No children sent from school on account of sickness.

No prosecutions for violations. The health officer has no trouble to induce citizens to observe and comply with all reasonable requests.

Total amount expended (health officers wages) only \$120.

Bryan has fine quarantine grounds one mile west from corporation line.

Two fine dairies with 50 cows, all in good healthy condition, good feed and fountain water, one of the dairy barns is the finest arranged and equipped establishment in the United States.

Infectious diseases reported during the year: Scarlet fever, 2 cases; whooping cough, none reported as severe; measles, some few cases, light.

BUCYRUS, CRAWFORD COUNTY.

Dr. W. A. Daugherty, health officer.

Population (estimated), 8,000.

This city is in a good sanitary condition. The board meets the first Wednesday of each month at the Mayor's office, and during the year have had a quorum at each session. Have had no trouble in enforcing the rules and all without litigation.

The only nuisance the Board has failed to abolish is the horrible condition of the river during the summer months. The board has, at several times asked Council to build an intercepting sewer, but all to no avail as yet.

The removal of night soil is very satisfactory to all concerned.

Contagious diseases are reported and properly quarantined and record kept of same. Scarlet fever (mild type) has been more prevalent than for years. No record is kept of those vaccinated, nor can Superintendent of schools say, as to how many are vaccinated.

The board has spent about \$600.00, all told, during the year.

Infectious diseases reported during the year: Scarlet fever, 58 cases; typhoid fever, 33 cases; whooping cough, 44 cases; measles, 15 cases; other infectious diseases, 33 cases.

BURBANK, WAYNE COUNTY.

Q. M. Dennis, health officer.

Population (estimated). 350.

Burbank is situated in a very healthy locality and although the sanitary condition is not the best we are troubled but very little with contagious or infectious diseases.

Our streets and yards are generally kept in a fair sanitary condition; but our alleys are not what they should be. Our sewerage system consists of open unpaved gutters or side drains and at times they become clogged and the drainage from hog-pens and stables is scattered, instead of being carried off as it should be.

There have been some nuisance notices served, but the parties who were maintaining a nuisance at once took steps to abate it.

There are no arrangements whatever for the removal of night soil or garbage.

We have a very few privies that have walled vaults, but the majority of them are either unwallled or have no vaults at all, but are on the edge of some embankment.

Contagious and infectious diseases have been with the exception of a couple of cases properly reported.

Scarlet fever has been the most prevalent in the past year.

Out of a total of eighty-one scholars in regular attendance at the public schools, thirty-four (34) are unvaccinated.

The board of health has maintained an active organization. They hold no regular meetings, but have had ten called meetings during the past year. They have been quite successful in the prevention of contagious diseases. We had a very few cases of scarlet fever, which was confined to three families. We had one case of typhoid fever which was brought here. It has never been known that a case of typhoid fever originated in this town.

The board has been successful in the abatement of all nuisances which they thought necessary to look after.

There have been no prosecutions for the violation of health laws or orders of the board of health.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 1 case.

BURTON, GEAUGA COUNTY.

Dr. B. F. Ray, health officer.

Population (estimated), 700.

Sanitary condition good! Have maintained an active organization and successful organization.

The streets are clean, but the alleys are filthy.

Night soil removed. The most litter!

No. 1, yes; 2d, yes; 3d, yes; 4th, none; 5th, yes; 6th, yes. Vaccinated during the year none. I am in the hole \$4.00 on matter. 50%. Meetings held of board of health during the year, three. Only pay to the printer. No prosecutions, after some, and they must come down. We have all of them thinking and we think they are coming to the faith, that cleanliness is next to godliness.

Infectious diseases reported during the year: Scarlet fever, 3 cases; whooping cough, 2 cases; measles, 4 cases.

BYESVILLE, GUERNSEY COUNTY.

Elza D. Trott, health officer.

Population (estimated), 1,200.

The sanitary condition of our village is fair.

Contagious diseases are not properly reported, and a record of those reported is not kept because the board has never furnished the necessary books.

Nothing has been done in regard to vaccination of children in the schools.

There has been more whooping cough and scarlet fever than any other infectious diseases.

Infectious diseases reported during the year: Scarlet fever, 18 cases; whooping cough, 65 cases; measles, 3 cases.

CALDWELL, NOBLE COUNTY.

A. H. Andrus, health officer.

Population (estimated), 2,000.

The present sanitary condition is good. Our board is in a good, healthy, active condition. Our streets and alleys are in a good condition. Our sewerage is fair, not the best. There are now no nuisances to my knowledge. I think all contagious diseases have

been reported. As near as I can learn about 50 children were vaccinated during last year. There are still some not successfully vaccinated. I do not know how many.

We have a man employed to remove garbage and filth of all kinds.

Board has met several times. Do not know how often. I do not know whether they keep a record of their meetings.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 7 cases; typhoid fever, 8 cases.

CALEDONIA, MARION COUNTY.

Noah Lee, health officer.

Population (estimated), 750.

Our streets, alleys, yards and out-houses were cleaned up in good shape by June 15th, 1899, and kept in a good sanitary condition. No cause for complaint from lack of sewerage. No nuisance that we have not successfully abated. We bury night soil and use slacked lime, ashes and road dust as disinfectants.

Contagious diseases are not properly reported. Doctors careless in that matter.

No vaccination for 18 years.

While we have not met regularly we have kept in close touch and awake to the approach of danger.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 1 case.

CAMBRIDGE, GUERNSEY COUNTY.

I. A. Oldham, health officer.

Population (estimated), 9,500.

Our streets, alleys and yards are in a fair sanitary condition.

Our sewerage system is good. The city has 6.51 miles of sanitary sewerage, and 1.32 miles of storm sewer; 902 house connections to curb, and proper man-

holes and flush tank to operate same. Sewerage discharge very satisfactory.

The board has been successful in abating nuisances.

Night soil is removed in air tight vessels to a farm adjoining the city, and there ploughed under. Garbage is removed to the city dump.

Contagious diseases are promptly and properly reported and record kept of same. Have enforced proper and restrictive measures. Typhoid and scarlet fever have been more prevalent than usual.

Less than one hundred persons have been vaccinated in the city during the year. Of the 1,660 pupils attending the schools, less than three hundred have been vaccinated.

The board of health has held seven meetings during the year.

Total amount expended, \$629.80.

Infectious diseases reported during the year: Diphtheria, 1 case; membranous croup, 2 cases; scarlet fever, 30 cases; typhoid fever, 20 cases; whooping cough, 4 cases; measles, 33 cases; other infectious diseases, 3 cases.

CAMDEN, PREBLE COUNTY.

John Whittaker, health officer.

Population (estimated), 1,200.

Our village is at present in very good sanitary condition. We have no difficulty in enforcing the orders and regulations of the board of health. It seems to be understood in the community that the board is supreme in matters that concern the general health, and there is no disposition to resist, except that there is in some cases a great objection to vaccination, and we have procured the vaccination of all the children we can without proceeding to extreme measures.

Our superintendent of schools reports forty-seven (47) children in attendance at school, who have not been vaccinated.

We have no public arrangement for the disposal of garbage, but require

each householder to keep his premises clean.

Nothing causes us any trouble except the hog pens in summer. We would drive them all out of the corporation, but we are not yet ready for an insurrection.

Our board is active. We met some five times the past year, and can have a meeting any time there is special need of it.

Expended during the year, \$75.00.

Number vaccinated, 125.

Infectious diseases reported during the year: Membranous croup, 1 case; typhoid fever, 3 cases; smallpox, 1 case.

CANAL DOVER, TUSCARAWAS COUNTY.

Henry Breitenstine, health officer.

Population (estimated), 6,000.

Streets, alleys and yards in good condition.

Contagious diseases are not properly reported. A record is kept as far as we can. Measles most prevalent. No vaccination that I know of. Board of health meetings, six. Amount of money spent, \$75.00.

No prosecutions for violations of health laws.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 9 cases; typhoid fever, 3 cases; measles, 30 cases.

CANAL FULTON, STARK COUNTY.

Joseph Ford, health officer.

Population, 1,500.

Our board maintained an active organization and has taken all proper care to preserve a sanitary condition within the village. There have been four cases of diphtheria and one of typhoid fever in the village during the year. There has been no cause for complaint from lack of sewerage and the streets and alleys are kept as clean as can be under

the circumstances. The arrangements for removing night soil and garbage is not so easily disposed of. The privies are simply left to fill up and new ones dug when the old ones become a nuisance. We have reports of contagious diseases once a year and sometimes oftener. There have been very few school children vaccinated during the year, and perhaps not more than one-third of the pupils in the school have been vaccinated at all. I am unable to state the number definitely. The board has not held more than three regular meetings during the year, there being no special duties to perform. These meetings have been neglected. The expenses have been small, not exceeding forty dollars during the year. There have been nineteen deaths from all causes within the corporation, but I have no means of knowing the causes of these deaths. None have died from any contagious diseases that I know of.

Infectious diseases reported during the year: Diphtheria, 4 cases; typhoid fever, 1 case.

CANAL WINCHESTER, FRANKLIN COUNTY.

Dr. W. S. Gayman, health officer.

Population (estimated), 800.

Sanitary condition good. The board meets third Monday every month.

Total spent by board, \$75.00.

CANFIELD, MAHONING COUNTY.

A. D. Wood, health officer.

Population, 700.

The streets, alleys and yards are in a sanitary condition. There are no nuisances which the board has unsuccessfully tried to abate. No arrangements are made for the disposal of night soil or garbage.

Contagious diseases are properly reported, but only a partial record is kept. Scarlet fever has been more prevalent than usual.

The board held one meeting during the year. Spent \$5.00 for disinfectants. No prosecutions were brought by the board.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 4 cases; measles, 1 case.

CANTON, STARK COUNTY.

Dr. J. F. Marchand, health officer.
Population (estimated), 40,000.

Our paved streets are regularly cleaned during the summer and fall months. They are scraped up. The public square the past summer and fall was cleaned daily by the block system. The paved streets were weekly flushed with water. Yards and alleys have been kept cleanly. We want more sewerage. Our sewerage system we think perfect. No nuisances which we have not been able to abate.

Night soil and garbage has been hauled out and used as fertilizer. We now have plans for a garbage furnace which we hope will be in operation within a few months.

All contagious diseases are promptly and properly reported, and records of same are kept. We have been able to enforce restrictive measures. Diphtheria was the most prevalent disease during the year. Scarlet fever the next. All of our public school children were vaccinated during the past year who had not been vaccinated within the past five years. Possibly total number of vaccinations during the year was 10,000. Parochial schools were vaccinated.

During the year there were held fourteen (14) meetings of the board of health.

The board spent during the year \$4,427.47. Of this amount \$1,547.47 was spent in taking care of smallpox cases developed in May and November. This amount included the building of a smallpox hospital, consisting of four rooms. Not a case of smallpox developed from these cases. All were treated at the pest house.

No prosecutions were made by the board during the year.

Infectious diseases reported during the year: Diphtheria and membranous croup, 195; scarlet fever, 16.

CARDINGTON, MORROW COUNTY.

H. Van Horn, health officer.
Population (estimated), 1,800.
No report.

Infectious diseases reported during the year: Scarlet fever, 24 cases; typhoid fever, 2 cases; measles, 1 case.

CAREY, WYANDOT COUNTY.

J. H. Ferrel, health officer.
Population (estimated), 2,000.

Sanitary condition is fair. We have a dumping ground provided for night soil and garbage. We have some cause for complaint from lack of sewerage. We enforce all ordinances regarding nuisances reported to the board.

Contagious diseases are being duly quarantined and taken care of. Have only had one contagious disease, scarlet fever. 90% of our school children under 12 years are unvaccinated perhaps. (Estimated.) Very few vaccinated during past year. Since the new board was appointed in July, have held two meetings per month.

No prosecutions. Expenses very light.

Infectious diseases reported during the year: Scarlet fever, 12 cases.

CARROLLTON, CARROLL COUNTY.

Dr. A. H. Hise, health officer.
Population (estimated), 2,000.

The board of health has not met for several months. No report to make.

CARTHAGE, HAMILTON COUNTY.

Harry Ross, health officer.

Population (estimated), 3,000.

The village is in a splendid sanitary condition. We have a first-class garbage system which accounts for same.

All contagious diseases are reported to us promptly and a record of same kept. I at once notify superintendent of schools and said patient cannot attend school until all danger is past, and then only on an order from health officer. At present there are but a very few attending school that have not been vaccinated. Two years ago I had all school children vaccinated.

The board does not meet very often, they leave the whole business to me. There has been no prosecutions. The people have a great respect for us and I have no trouble to abate a nuisance.

The physicians and undertakers deserve much credit in this locality as they work to the interest of the board of health in all cases.

Expenses per year are as follows: Salary for health officer \$150.00; small-pox patient in May 1899, \$165.45; total \$315.45.

Infectious diseases reported during the year: Scarlet fever, 15 cases; typhoid fever, 2 cases; small-pox, 1 case.

CEDARVILLE, GREENE COUNTY.

D. H. McFarland, health officer.

Population (estimated), 1,800.

The sanitary condition is good. Our streets and alleys are kept clean.

Contagious diseases are not reported at present time, nor given proper name. The small-pox we are having at present was reported as swine-pox in one case and scarlet fever in another case. We have had since October 1899, up to the present time, Jan. 20, 1900, 17 cases of small-pox with one death.

We have at present, 12 cases under quarantine.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 1 case.

CELINA, MERCER COUNTY.

Dr. L. P. Lisle, health officer.

Population (estimated), 3,500.

The sanitary condition of our town is very bad. Our board has kept an active organization, but has been unable to abate certain nuisances on account of our council postponing action on recommendations referred to them by our board.

Streets, alleys and yards are kept in a fair condition.

We have no sewerage except a line of small pipes running north and south through two alleys about two-thirds across our town. They have no outlet worth mentioning and being private, our waterworks trustees will not allow them to be flushed, and these lines are used by quite a number of families for all purposes and the consequences are, we have a horrible state of affairs, at times positively unbearable, and the only way I know of for the State Board to become acquainted with the facts is to come here and see for yourselves. Our board of health has tried to abate the nuisance by working through our council but we cannot succeed, nor never will we, until the State Board takes hold of the matter.

Night soil is carted outside of the corporation limits and buried.

Contagious diseases are reported, and a record is kept of same. The board has been able to adopt proper restrictive measures. Diphtheria most prevalent. Number of vaccinations 412. Impossible to find out number of unvaccinated.

Nine meetings held during the year.

Amount expended \$446.00. No prosecutions ordered for violation of orders.

Infectious diseases reported during the year: Diphtheria, 12 cases; scarlet fever, 2 cases; small-pox, 1 case.

CENTERBURG, KNOX COUNTY.

J. C. Coe, health officer.

Population (estimated), 700.

Sanitary condition, good. Board has maintained an active organization, and has been successful in every respect.

Infectious diseases reported during the year: Scarlet fever, 40 cases; typhoid fever, 3 cases.

CHAGRIN FALLS, CUYAHOGA COUNTY.

W. J. Clark, health officer.

Population, 2,000.

Streets, alleys, yards and public grounds are in a cleanly and sanitary condition. There is cause for complaint about sewerage. Sewage (what there is) runs into the river and creeks in village. Have had no nuisance but that we have abated. Night soil is part thrown away and part buried.

Contagious diseases are not properly reported by all physicians or householders and no record is kept. Board has enforced restrictive measures. Whooping cough was more prevalent than usual. A large number of children and people were vaccinated during the year. Most of children attending school were vaccinated in the early part of 1899.

The board of health aims to hold monthly meetings on the third Thursday of each month and oftener if necessary. During the month of March, latter part, and first part of April, held daily meetings on account of small-pox, and in month of December held several meetings on account of one case of small-pox. In March, about the 21st, the board received notice of a case of small-pox in Bainbridge Tp., Geauga Co., adjoining our village, and of the case in village. The board compelled the trustees of Bainbridge Tp., to maintain a quarantine against the home, which afterwards developed two more cases. We had in the village only two cases which the board confined to the two houses where patients were located.

The board recommended general vaccination which was complied with by the people. Had one case of small-pox in December, a middle-aged woman. Where she contracted the disease, she can't tell. We confined the disease to that one case.

The board has spent about \$700.00 in the last year. No prosecutions of any kind have been brought by the board.

Infectious diseases reported during the year: Small-pox, 3 cases.

CHICAGO JUNCTION, HURON COUNTY.

Dr. D. H. Young, health officer.

Population (estimated), 2,800.

The sanitary condition as good as could be expected from the condition of the open ditches and sewerage. Night soil removed in tight barrels. Garbage hauled away in same manner.

Contagious diseases are promptly reported. Typhoid fever more prevalent than any other.

Cannot tell as the amount came through the Council.

No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 4 cases; measles, 1 case.

CHILLICOTHE, ROSS COUNTY.

Dr. J. M. Hanley, health officer.

Population, 16,000.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate. The city is divided into four districts and the garbage is removed daily. By the use of the Telephone Police Patrol service of the city, the sanitary cartmen while on duty can call up the office at any time and are under instructions to do so at 10 A. M., and 3 P. M., each day that they are on duty in order to attend any

complaint that may be sent in. The night soil is removed by regularly licensed vault-cleaners who remove night soil between the hours of 10 P. M., and 5 A. M., in air tight conveyances.

Contagious diseases are properly quarantined and a record is kept. The board has been able to enforce proper restrictive measures. Whooping cough has been more prevalent than usual. All school children are successfully vaccinated.

The board held 15 meetings during the year. Amount spent, \$3,201.59.

No prosecutions were brought.

Infectious diseases reported during the year: Diphtheria, 31 cases; membranous croup, 1 case; scarlet fever, 22 cases; whooping cough, 88 cases; measles, 12 cases.

CLARINGTON, MONROE COUNTY.

John E. Morrill, health officer.

Population, 1,000.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage are carted out of town and buried.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. The board held four meetings during the year. Amount spent, \$35.00. The only prosecution brought by board was for the violation of quarantine orders. The mother of a boy about fifteen years old permitted him to go out and play ball in violation of quarantine notice. He was just scaling from scarlet fever. I filed complaint before the mayor and conviction was had. She was fined \$10.00 and costs which were paid.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 2 cases; measles, 1 case.

CLEVELAND, CUYAHOGA COUNTY.

Dr. Geo. F. Leick, health officer.

Population, 395,000.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate. Night soil goes into Lake Erie, and garbage is reduced by the Buckeye Refuse Destruction Co.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. Smallpox has been more prevalent than usual.

The board spent \$36,140.29 during the year.

Infectious diseases reported during the year: Diphtheria, 522 cases; membranous croup, 50 cases; scarlet fever, 1090 cases; typhoid fever, 218 cases; smallpox, 106 cases; whooping cough, 142 cases; measles, 238 cases; other infectious diseases, 154 cases

CLEVES, HAMILTON COUNTY.

Dr. C. W. Smedley, health officer.

Population (estimated), 1,800.

Our streets are all macadam and there is no cleaning done. Repairs are kept up and with but very few exceptions yards are in good order. We are situated in the river bottom, with a hill on the east. No provisions for drainage, except surface drainage, but the question of sewers is being agitated at present. Nuisances have been promptly abated. No provision for the removal of night soil or garbage.

Contagious diseases are promptly reported and all due measures taken to prevent spreading. So far no record of the cases has been kept. Our health board was organized in October, 1899. Since then there have been no epidemics of any kind. Had smallpox near us last

spring and all school children were vaccinated by order of board of education. There have been no meetings of the board of health since organization. No expense has been incurred, except salary of health officer, \$120.00 per annum. There have been no prosecutions, but am having some difficulty in death and birth returns. Their report has never been required heretofore.

Our burying ground is in Whitewater Tp., and we are in Miami. Have seen the township clerk of Whitewater, and he assures me he will permit no bodies to be brought in without a proper certificate, but we own the cemetery and the trustees seem to think that is sufficient. Feel confident that the affair will be adjusted without any legal steps. Our birth reports have never been made except as they occurred in the practice of the health officer, but as all physicians have been supplied with proper blanks and my intention is to make monthly calls for the reports, I do not anticipate any trouble on that score.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 1 case.

CHATFIELD, CRAWFORD COUNTY.

Joseph H. Mollenkop, health officer.
Population (estimated), 300.

Sanitary condition is good. Night soil is buried in rear of lots. Cannot get it hauled out. We have a poorly organized board; have scarcely any meetings.

The measles last spring was only epidemic we had. The expense of board was not more than \$5.00, I think. It seems hard to keep an organized board here.

Infectious diseases reported during the year: Measles, 103 cases; other infectious diseases, 7 cases.

CHICKASAW, MERCER COUNTY.

H. S. Schaefer, health officer.
Population (estimated), 450.

Local board here was organized in November, 1899, and meets first Tuesday in each month of the year as regular meeting, besides call meetings.

Rules, regulations and ordinances for prevention of contagious diseases have been adopted and are strictly enforced.

Streets and alleys are kept clean from garbage, etc.

Contagious diseases are promptly reported. A record of contagious diseases is kept. No vaccination since board of health existed here. Total number of children in schools, 118. Vaccinated, 1; unvaccinated, 117.

Board of health met three times last year. Total amount spent by board, about \$15.00 for supplies and records.

Infectious diseases reported during the year: Scarlet fever, 1 case.

CIRCLEVILLE, PICKAWAY COUNTY.

John L. Cummins, health officer.
Population (estimated), 7,000.

Streets, alleys and yards are in good condition. There is cause for complaint for lack of sewerage. No nuisances which the board was unable to abate. Our board has maintained an active organization and has been successful in enforcing all proper measures.

Night soil is removed late at night and deposited outside of city limits.

Contagious diseases are promptly reported and record of same kept.

Board has been able to enforce all rules.

No one vaccinated during the year.

No. of unvaccinated school children, 950. Board held eight meetings. Total amount spent, \$137.00. No prosecutions.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 2 cases; typhoid fever, 9 cases; whooping cough, 1 case.

CLYDE, SANDUSKY COUNTY.

F. G. Tuttle, health officer.

Population (estimated), 3,000.

Sanitary condition of village good. No complaint from lack of sewerage. No nuisances but what we have been able to take care of. Night soil and garbage are taken care of by owner of property. Contagious diseases are promptly reported. A record is kept by health officer of all contagious diseases. Have not had any serious trouble to enforce the law. Scarlet fever has been more prevalent than any other disease. No vaccinating done to my knowledge. Can't give you the number of meetings during the year. The health officer's salary is \$84.00 per year. There has been no prosecutions.

Infectious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 27 cases; typhoid fever, 15 cases; chickenpox, 11 cases; measles, 1 case.

COLDWATER, MERCER
COUNTY.

Jacob Schwartz, health officer.

Population, about 600.

Streets, alleys and yards in a cleanly condition. There is no cause of complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board of health has unsuccessfully tried to abate. The removal and disposition of night soil and garbage was attended to.

Contagious diseases are not properly reported, but a record is kept of such as are. We have been able to enforce proper restrictive measures. Diphtheria has been more prevalent than usual. \$144.00 was spent during the year. No prosecutions were brought by the board.

Infectious diseases reported during the year: Diphtheria, 4 cases.

COLLEGE HILL, HAMILTON
COUNTY.

J. E. Deininger, health officer.

Population (estimated), about 1,500.
No report.

Infectious diseases reported during the year: Typhoid fever, 3 cases.

COLLINWOOD, CUYAHOGA
COUNTY.

P. E. Kerlin, M. D., health officer.

Population (estimated), 3,400.

The streets, alleys and yards are in a reasonably clean condition. There has been no sewerage system in use in the village. The people are at great inconvenience in disposing of garbage. The hotels mostly have it hauled away, while the people in general scatter it over the ground. All nuisances as far as possible have been abated.

The village through its board has under contract system the removal of night soil in January, April, July and October. The night soil is deposited on nearby farms.

All contagious diseases as far as possible have been reported, and a proper record of the same kept.

The board has been successful in enforcing proper restrictive measures.

With the exception of "grippe" one year ago there have been no epidemics of contagious diseases.

There have been vaccinated during the year about 250, and as near as I can estimate there are about 50 unvaccinated in public and parochial schools.

The board has held during the year five special and six regular meetings. The amount spent by the board during the year is given as follows: Removal of night soil, \$682.70; quarantine of smallpox, \$111.36; salary of clerk, \$100.00; salary of health officer, \$100.00; salary of sanitary police, \$125.00; for other purposes, \$26.75; total for all purposes, \$1,145.81.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 2 cases; typhoid fever, 7 cases.

COLUMBIANA, COLUMBIANA COUNTY.

Geo. Roninger, health officer.

Population (estimated), 1,800.

The streets, yards and alleys are in a good condition and there is no complaint from lack of sewerage. The removal of night soil and garbage is carefully attended to. Twice a year every one must have the night soil taken away and properly cared for.

Contagious diseases are properly reported, but during the last year there has been no contagious disease among the people.

There has only been very few persons vaccinated during the year and especially among the school children a few have been vaccinated of their own will, as the rule has not been enforced in the school. I cannot tell why, but I think some objection among the board, therefore, most of the school children are unvaccinated. Four meetings are held a year and the amount spent during the year is about fifty dollars.

There have been no prosecutions brought by the board of health for the violation of its orders or of its health laws.

Infectious diseases reported during the year: Typhoid fever, 9 cases.

COLUMBUS, FRANKLIN COUNTY.

Dr. Wm. D. Deuschle, health officer.

Population (estimated), 140,000.

Streets, alleys and yards in a fairly good sanitary condition. Much cause for complaint of lack of sewerage on west side of city. Generally successful in abating all nuisances.

Night soil removed by vault cleaners to whom permits are issued. No common dumping ground provided, but deposited promiscuously outside the city limits, which is the cause of numerous complaints from country residents.

Garbage removed and disposed of by Columbus Sanitary Co.

Contagious diseases are not reported as completely as should be done.

No, our physicians are negligent in this regard. A record of contagious diseases is kept. We are able to enforce proper restrictive measures.

Smallpox and chickenpox have been more prevalent than usual.

During the past year 8,404 children attending public schools were vaccinated and re-vaccinated.

In October, 1899, out of 17,200 there were 568 who had never been vaccinated. Many of these have since been vaccinated. Those who have not been have almost without exception brought certificates from reputable physicians stating that physical conditions were such as to make it unwise to have it done.

Should a serious epidemic of smallpox arise we would have all such pupils excluded from the schools.

It is impossible to determine the number of persons vaccinated in the city during the year, since but few physicians keep a record of these cases and can consequently give no information on the subject.

Any future information regarding vaccination statistics will be forwarded you.

No prosecutions for violations of health laws have been brought during the year.

Infectious diseases reported during the year: Diphtheria and membranous croup, 105 cases; scarlet fever, 91 cases; typhoid fever, 161 cases; smallpox, 252 cases; whooping cough, 26 cases; measles, 322 cases; other infectious diseases, chickenpox, 95 cases.

COLUMBUS GROVE, PUTNAM COUNTY.

Dr. W. H. Begg, health officer.

Population (estimated), 2,000.

Streets and alleys are in a very good condition. The health board meets on

call of President at the request of health officer. Have had no trouble in enforcing the orders of the board.

The village council provides a place one mile from the village where garbage is hauled and deposited. Contagious diseases promptly reported and restriction easily enforced. No vaccination during the year. Board of health held four meetings and spent \$85.00. No prosecutions were necessary during the year.

Infectious diseases reported during the year: Membranous croup, 2 cases; scarlet fever, 23 cases; typhoid fever, 4 cases.

CONNEAUT, ASHTABULA COUNTY.

Dr. William H. Leet, health officer.
Population (estimated), 6,000.
No report.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 2 cases; typhoid fever, 75 cases; whooping cough, 3 cases.

CONTINENTAL PUTNAM COUNTY.

Brooks Paden, health officer.
Population (estimated), 1,600.

The sanitary condition of village is very bad.

Board has not maintained an active organization and has not taken proper measures for the prevention of contagious diseases and the abatement of nuisances.

Our streets and alleys are in a bad condition. There have been no arrangements made for removal of night soil and garbage.

Contagious diseases are not properly reported, and no record is kept of same. The board has not enforced proper restrictive measures. Scarlet fever in light form has been more prevalent than usual. Cannot give number of vaccinations during the year. Number of

children unvaccinated in school, 170. Number of meetings held by the board during the year, five. Amount spent by the board during the year, \$18.25.

CONVOY, VAN WERT COUNTY.

Dr. R. L. Crooks, health officer.
Population (estimated), 900.

This place is kept in a fair sanitary condition. All contagious diseases are reported and proper steps at once taken to prevent spread of same. Our schools and school building are watched carefully and kept in the best sanitary condition. Streets and alleys are kept free from garbage and offal of all kinds.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 1 case; scarlet fever, 4 cases; typhoid fever, 4 cases.

CORNING, PERRY COUNTY.

A. A. Bock, health officer.
Population (estimated), 1,700.

Our board has not maintained an active organization.

Our streets and alleys are in a cleanly condition.

There is complaint from the lack of sewerage and from an improper discharge of sewage.

No nuisances which the board has unsuccessfully tried to abate.

Arrangement for the removal of night soil and garbage is as follows: Whenever any night soil or garbage needs removing I notify the people and they notify some one in that business, and he removes said night soil and garbage to the city dumping grounds just outside of city limits.

Contagious diseases not properly reported. No record of such diseases kept unless some one dies therefrom; then I receive a death certificate from undertaker.

The board has not tried to enforce proper restrictive measures.

Typhoid fever and measles have been more prevalent than usual.

Estimated number of people vaccinated during the year, 25.

Number of children attending public and parochial schools unvaccinated, 306.

The board has held one meeting during the year.

Total amount spent by the board during the year, \$72.00, including health officer's salary, which is \$600.00. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 7 cases; measles, 12 cases.

persons have been vaccinated during the year. Sixty-three per cent. of the school children are unvaccinated.

The board of health has held four meetings during the year. The board spent \$192.48 during the year, exclusive of health officer's salary and expenses of delegates to annual meeting of state and local boards of health.

No prosecutions were brought by the board.

Infectious diseases reported during the year: Diphtheria, 16 cases; scarlet fever, 58 cases; typhoid fever, 17 cases; smallpox, 10 cases; whooping cough, 15 cases; measles, 50 cases; other infectious diseases, 19 cases.

COSHOCTON, COSHOCTON COUNTY.

J. E. Foster, V. S., health officer.

Population (estimated), 7,500.

The present sanitary condition of our city is fair. The board has maintained an active organization, but has met only four times during the year. It has through its health officer been successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances.

Our streets are in good sanitary condition, but the alleys and some yards need to be looked after very often. There is no cause for complaint from lack of sewerage or from improper discharge of sewage. The board has not been unsuccessful in abating any nuisances which it attempted to abate.

Night soil is removed to the country in water tight tanks and is deposited on the ground and then plowed under. Garbage is simply hauled near the edge of the city and is there allowed to decompose. Some is removed by men in the country who are engaged in the swine industry. Contagious diseases are properly reported and a record of the same is kept. Restrictive measures have been properly enforced.

Smallpox and diphtheria have been more prevalent than usual. About 161

COVINGTON, MIAMI COUNTY.

Geo. Flammer, health officer.

Population (estimated), 1,800.

Sanitary condition fair. Have had no cause for prosecutions. Streets in fine condition, but alleys are filthy. Property owners remove their own garbage. Night soil is generally hauled out on farms. Contagious diseases are properly reported. Contagious disease record is kept. The health officer has been able to enforce restrictive measures. No one has been vaccinated during the year. The secretary has no minute of any meeting being held during the year.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 1 case.

CRESTON, WAYNE COUNTY.

Philip Baum, health officer.

Population (estimated), 1,100.

Number meetings held since organized, August 29, 1899, seven. Money paid out since organized, \$13.33. No prosecutions. Streets and alleys in fair condition. There is cause for complaint from lack of sewerage. All nuisances abated that board attacked. No arrangement made for disposal of night soil

other than health officer has made a few special demands to clean privies and they were obeyed. Contagious diseases are reported and looked after by proper officer and a record is kept of such cases. Proper restrictive measures were enforced.

Number of diphtheria, scarlet fever and typhoid fever. Measles and chickenpox average about the same each.

Number of children attending our schools not vaccinated, 106.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 1 case; typhoid fever, 2 cases; measles, 1 case; other infectious diseases, chickenpox, 2 cases.

CRIDERSVILLE, AUGLAIZE COUNTY.

Benjamin Bloyer, health officer.

Population, 700.

All streets, alleys and yards are kept in a cleanly condition. Contagious diseases are properly reported and a record kept. The board has been able to enforce proper restrictive measures. The board held five meetings and expended \$75.00. About twenty persons were vaccinated.

Infectious diseases reported during the year: Scarlet fever, 1 case; smallpox, 3 cases.

CUMBERLAND, GUERNSEY COUNTY.

G. E. McEndree, health officer.

Population (estimated), 600.

Streets and alleys are in good condition. No complaint from lack of sewerage. No nuisances.

Night soil removed at night in carts, all garbage removed by same.

Contagious diseases are properly reported, but no record kept.

Board has been able to enforce restrictive measures. Scarlet fever more prevalent than usual but in a very light form.

Do not know how many vaccinations. Board met three times. No expenses. No prosecutions. Number of scholars not vaccinated in school, 80.

Infectious diseases reported during the year: Scarlet fever, 6 cases; measles, 2 cases.

CUYAHOGA FALLS, SUMMIT COUNTY.

I. N. Reid, health officer.

Population (estimated), 3,500.

The streets are in good condition, except the business street, Front Street, which is in bad condition and is the cause for loud complaint, it is something terrible in the summer time.

We have no sewerage and are in bad shape for want of it.

Night soil is removed by wagon at night. Contagious diseases are reported as a general thing sometimes (not very often) the doctors differ as to the nature of the disease.

Superintendent of schools reports 280 children in schools are unvaccinated out of an enrollment of 620.

Board of health has held 5 regular meetings during the year. They have not spent over \$30.00, (can't tell exactly at this time the amount) every thing has been well attended to.

DALTON, WAYNE COUNTY.

A. H. Arick, health officer.

Population (estimated), 800.

No report.

Infectious diseases reported during the year: Diphtheria, 6 cases; typhoid fever, 8 cases; whooping cough, 5 cases.

DARBYVILLE, PICKAWAY COUNTY.

M. N. Bowman, health officer.

Population (estimated), 370.

No report.

Infectious diseases reported during the year: Typhoid fever, 2 cases.

DAYTON, MONTGOMERY
COUNTY.

Dr. C. W. King, health officer.

Population (estimated), 85,000.

The sanitary condition of our city is good. Its streets, alleys and yards being kept in a cleanly condition, and there being no cause for complaint from lack of sewerage, or from an improper discharge of sewage. Our board has been successful to a remarkable degree in its efforts to abate nuisances.

The garbage and night soil from our city are both disposed of at the crematory, the removal of the garbage being under the direct control of the Board of City Affairs and done by contract. Night soil is only permitted to be removed by those holding permits so to do from this Board.

We believe all contagious diseases except typhoid fever and whooping cough are reported promptly, these seldom. The number of deaths from typhoid fever in 1899 were 31 while only 12 cases were reported. A record is kept in our office of all cases reported. And our board has had no trouble in enforcing proper restrictive measures.

Scarlet fever and diphtheria have been our most prevalent contagious diseases during the year.

Number of free vaccinations of school children during the year about (1,200) twelve hundred, total vaccinations estimated at about 2,500. The number of unvaccinated children attending the district schools, 825; high school, 46; parochial schools, about 400; total 1271.

Our board has held during the year twenty-one meetings, twelve of which were regular, and nine special.

Total amount expended by the board during the year in its regular work is (4,063.30) four thousand and sixty-three dollars and thirty cents. From special fund during small-pox period (\$3,-465.98) thirty-four hundred and sixty-five dollars and ninety-eight cents.

No prosecutions of any nature were brought by the board for violation of any of its orders or any health laws.

Infectious diseases reported during the year: Diphtheria, 74 cases; membranous croup, 5 cases; scarlet fever, 110 cases; typhoid fever, 12 cases; small-pox, 35 cases; measles, 14 cases; other infectious diseases, 8 cases.

DEFIANCE, DEFIANCE COUNTY.

Dr. E. E. K. Chapman, health officer.

Population (estimated), 10,000.

The sanitary condition of our city is excellent. We have a very efficient active organization. Our board is composed of competent, wideawake members, who are alive to the interests of our city and the sanitary measures. We have been very successful in stamping out contagious diseases and the abatement of nuisances. Our streets and alleys are kept in a clean condition at all times. In portions of our city we lack in sewerage, but are constantly improving. On the whole we have a well sewered city. The removal of night soil and garbage is under the supervision of the sanitary police and disposed of to the fertilizer works. Contagious diseases are reported promptly, and a record kept of the same. The restrictive measures are also carried out. The prevalent contagious disease has been measles. No vaccinations the past year. Ten regular and four special meetings of the board were held.

No prosecutions and no violation to require prosecution.

Number of unvaccinated children, 887.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 1 case; scarlet fever, 12 to 14 cases; typhoid fever, 23 cases; whooping cough, 12 to 15 cases; measles, 290 to 300 cases.

DEGRAFF, LOGAN COUNTY.

J. W. Hendershott, health officer.

Population (estimated), 1,300.

The present sanitary condition in our village is of the very best, of which we

are proud. Our streets, alleys and yards are in a cleanly condition.

Contagious diseases are properly reported and are properly quarantined, the laws of the State Board of Health have been rigidly enforced.

Scarlet fever has been the only contagious diseases, have had only 3 cases.

The board meets the 4th Friday of each month. I am glad to report that we have a good working board and are trying to keep up our good name by making ours a model village from a sanitary point of view.

I am sorry to say that a great majority of school children are unvaccinated.

Infectious diseases reported during the year: Scarlet fever, 4 cases.

DELAWARE. DELAWARE COUNTY.

Dr. D. E. Hughs, health officer.

Population (estimated), 10,000.

Sanitary condition is fairly good. Have no sewerage system and a good deal of improper drainage. All nuisances have been abated.

Night soil and garbage are removed by a scavenger out of the city and buried.

Contagious diseases are reported properly, and record kept. Restrictive measures have been enforced without much trouble. Most prevalent contagious diseases have been small-pox and scarlet fever.

Over 1200 school children have been vaccinated. Hard to estimate the number outside of that. 90% of all pupils in public and parochial schools have been vaccinated.

Health board has had fifteen meetings during the year. Amount spent about \$2,000.

Have had no prosecutions.

Infectious diseases reported during the year: Diphtheria, 12 cases; membranous croup, 2 cases; scarlet fever, 25 cases; typhoid fever, 35 cases; small-pox, 44 cases; whooping cough, 15 cases; measles, 25 cases; other infectious diseases, 10 cases.

DELL ROY, CARROLL COUNTY.

Isaac Russell, health officer.

Population (estimated), 500.

Sanitary condition good. Streets, alleys, yards etc. in good condition.

Our report is not as satisfactory as we would like to have it, as there was no board properly organized for the last year.

In regard to vaccination of the pupils of our schools there has been none done.

DELTA, FULTON COUNTY.

W. Ramsey, health officer.

Population (estimated), about 1,700.

Our sanitary condition is excellent. We maintain a good organization and meet the last Monday of each month or oftener if necessary. Streets and alleys are kept in good condition. Night soil is hauled out on farm fields.

Contagious diseases are properly reported and a record kept.

The superintendent cannot answer in reference to vaccination. No prosecutions and no vaccinations during the last number of years.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 5 cases.

DENNISON, TUSCARAWAS COUNTY.

Dr. L. H. Hughes, health officer.

Population (estimated), 4,500.

No report.

Infectious diseases reported during the year: Diphtheria, 16 cases; membranous croup, 5 cases; scarlet fever, 5 cases; typhoid fever, 50 cases; whooping cough, 84 cases; measles, 15 cases.

DEXTER CITY, NOBLE COUNTY.

W. A. Tilton, mayor.

Population (estimated), 200.

I appointed a board of health last spring, but they have never met to or-

ganize, and have done nothing. The sanitary condition of our town is good and there have been no contagious diseases, and there have been no deaths in the last year.

DILLONVALE, JEFFERSON COUNTY.

Dr. C. W. Mercer, health officer.

Population (estimated), 1,500.

The streets, alleys and yards are not in the best condition owing to the great number of foreigners living here, but they are in much better sanitary condition than they were a year ago. There are no nuisances now of any importance. Most of the contagious diseases are properly reported, but a true and complete record has not been kept, as I have only been appointed since last August and then only as sanitary officer in connection with Dr. McMillan. This township has practically no regularly appointed health officer. Vaccination was thoroughly practiced here about three years ago, but there has been no vaccinating done since. Board of health has held three meetings since August. They have spent about \$400 since August, principally for antitoxine. There has been no prosecutions. The mortality report is not complete, but is practically correct since August last. Diphtheria has been the most prevalent disease and all cases have been quarantined and all houses fumigated.

I would be much pleased to make a correct and complete report, but it is quite impossible under the circumstances.

Infectious diseases reported during the year: Diphtheria, 45 cases; membranous croup, 3 cases; scarlet fever, 1 case; typhoid fever, 2 cases; whooping cough, 20 cases; measles, 35 cases.

DOYLESTOWN, WAYNE COUNTY.

Dr. A. E. Stepfield, health officer.

No report.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 3 cases.

DRESDEN, MUSKINGUM COUNTY.

George Sparks, health officer.

Population (estimated), 2,000.

I have to say that the operations of our board of health during the past year have been very limited indeed on account of not having held but one or two meetings as a board and not doing very much then. I have been sick with organic heart disease for about a year and not able to do much and the whole matter rests with me. We had four or five cases of typhoid fever. One death.

There has been a number of cases of sore throat, supposed to be diphtheria, but our physicians are very reticent about such things and we can get none of them to serve on the board or act as health officer, as we all serve without compensation, except the health officer, and he gets \$60 per annum. Our town is in good sanitary condition; the health officer and myself drive over the town every month or so and see that it is kept in good shape. We organized our health board in 1881; I was elected clerk of the board then and have been continuously ever since, and it has come to be that everybody calls me "the board of health." Our drainage is good, sewerage not bad, 140 vaccinations last year. I have not ascertained the number of unvaccinated yet, but will soon. We should be glad to have a physician for our health officer, but there is nothing in it for them. Our present health officer is our town marshal.

(Signed.)

JOHN F. POORMAN, Clerk.

DUBLIN, FRANKLIN COUNTY.

Dr. L. McKittrick, health officer.

Population (estimated), 400.

Streets, alleys and yards are in good condition. Sewerage is all right. There are no nuisances. Night soil is hauled away and in some places on the surface of limestone it is carried off through the crevices in the rock. Contagious diseases are properly reported and a record is kept. We have enforced every measure. We have had no contagious disease during the past year except two or three cases of chickenpox which was reported last March or April. There are 19 pupils who have not been successfully vaccinated.

We have had two meetings. No prosecutions.

DUNKIRK, HARDIN COUNTY.

Dr. J. S. Hedrick, health officer.

Population (estimated), 1,500.

The local sanitary conditions are good. Streets, alleys and yards are comparatively clean. No cause for complaint from the lack of sewerage. The local board has been able to successfully abate all nuisances. We have a tract of land one mile from town upon which all night soil, etc., is dumped, it being at least one-half mile from any residence.

All contagious diseases are promptly reported and record of same kept. We have at all times been able to enforce proper restrictive measures.

The diseases being more prevalent than usual during the past year have been scarlet fever and an eruptive disease diagnosed as "Impetigo," presumably modified smallpox.

The board of health has held thirteen meetings during the year. There have been no prosecutions for violation of orders issued by board of health.

As president of the board of education I have investigated as to the number of unvaccinated children attending the public schools and find a very large per cent. have never been vaccinated,

250 or more. There has not been over 10 or 12 persons vaccinated during the year.

Infectious diseases reported during the year: Scarlet fever, 12 cases; smallpox ("impetigo"), 14 cases; whooping cough, 4 cases; measles, 1 case; other infectious diseases, 6 cases.

DUPONT, PUTNAM COUNTY.

A. L. Bennett, health officer.

Population (estimated), 325.

Number of meetings of the health board during the year ending December 31st, 1899, was two.

The worst thing in the way of nuisances is the disposition of the residents to yard and feed cows, pigs, etc., near their residences.

Some will also persist in raking a lot of damp garbage into heaps and set fire to the same, thus setting afloat a very obnoxious and stifling smoke or gas. These two matters annoy me considerable. Sanitary condition is fair.

Infectious diseases reported during the year: Membranous croup, 1 case; typhoid fever, 1 case. measles, 3 cases; other infectious diseases, chickenpox, 2 cases.

EAST CLEVELAND, CUYAHOGA COUNTY.

J. H. Stamberger, health officer.

Population (estimated), 2,500.

During the past year the sewer system (Waring) recently built has been put into operation and the system is being extended continually. The general sanitary condition of the village is good. As the sewer system is extended to new territory, the use of cess pools is discontinued and the filling up of the same encouraged. Only one case of contagious disease reported. The house was properly quarantined, and the patient, who had only a light attack, recovered quickly.

Infectious diseases reported during the year: Scarlet fever, 1 case.

EAST LIVERPOOL, COLUMBIANA COUNTY.

Dr. C. B. Ogden, health officer.
Population, 1,800.

The sanitary condition of the city is excellent. Our board has maintained an active organization and has been very successful in preventing the spread of contagious diseases.

There is some complaint in regard to lack of sewerage. Night soil is removed by a man under bond.

Contagious diseases are properly reported and a record kept. Typhoid fever has been more prevalent than usual. About all the school children are vaccinated.

The board held ten meetings and expended \$1,700.

Infectious diseases reported during the year: Diphtheria, 15 cases; membranous croup, 1 case; scarlet fever, 35 cases; typhoid fever, 54 cases; small-pox, 1 case; measles, 24 cases.

EATON, PREBLE COUNTY.

P. Campbell, health officer.
Population (estimated), 3,500.

The condition of the town is good. The board met a few times and spent some money.

We have had no contagious diseases amount to anything.

I think this is all I can report, for the only way I have of finding out anything is to go to the physicians, and they hardly ever report anything. I cannot fill out the blank on the other side for this is all I can do.

EDGERTON, WILLIAMS COUNTY.

Calvin Hathaway, health officer.
Population (estimated), 1,500.

Our village is in a good sanitary condition. The physicians do not report to the health officer all of their infectious and contagious diseases. I am unable

to make a correct report, or I would have sent it in by the required time. But we are all right. I stamp out any and all contagious or infectious diseases as soon as it makes its appearance.

Infectious diseases reported during the year: Typhoid fever, 2 cases; whooping cough, 10 cases.

EL DORADO, PREBLE COUNTY.

Dr. A. C. Carney, health officer.
Population (estimated), 500.

Streets, alleys etc., in cleanly condition. We have no sewerage system. Night soil and garbage are removed by each person at his own expense.

We have not now, neither have had any contagious diseases.

42 unvaccinated school children.

Twelve meetings. Ten dollars to sanitary officer and for printing.

No prosecutions.

ELIDA, ALLEN COUNTY.

A. J. Myers, health officer.
Population (estimated), 400.

Present sanitary condition of village good. Streets and alleys are in good condition.

Contagious diseases are properly reported and promptly looked after.

Board meets as often as necessary, from three to six times during the year. There was a new board of health appointed November 1899 and Dr. S. A. Hitchcock is the health officer now.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 14 cases; typhoid fever, 3 cases; whooping cough, 1 case.

ELMORE, OTTAWA COUNTY.

Dr. S. T. Dromgold, health officer.
Population (estimated), 1,000.

Our streets are in first-class condition—sanitary condition all over town first-class.

All contagious diseases are promptly reported and a record kept. The board has no trouble to enforce any measure thus far attempted.

None vaccinated, at least none reported.

Our board does not meet, but the health officer and sanitary officer conduct the whole business, which is upheld by the Mayor and Council, so that everything is carried out to the letter, and our village is in first class condition in every particular.

Amount spent for salaries \$24.00.

There is no complaint from lack of sewerage and no nuisances the board has been unable to abate.

Infectious diseases reported during the year: Typhoid fever, 1 case; measles, 1 case.

ELMWOOD PLACE, HAMILTON COUNTY.

Dr. E. T. Busching, health officer.
Population (estimated), 3,200.

All streets and yards in good condition with the exception of Carthage Pike which is under the jurisdiction of the County Commissioners. This is very dirty and badly needs repairs all through our valley. We have no alleys. Our village is badly in need of better sewerage, there being only one or two small catch basins in the village.

Night soil is conveyed across Mill Creek and buried in holes four feet under ground. Our garbage and ashes are carried across the above creek and dumped there. We have had only one nuisance which we could not abate arising from sink-water running from one man's property down hill into that of another. We could not make the owner drain to the street as the back part of his house lies lower than the street. This nuisance is still "in statu quo."

Contagious diseases are properly reported, a proper record kept and restrictive measures fairly well enforced.

During past year measles have been

by far the most prevalent disease, many cases not being reported.

During the year there have been 269 to 300 children vaccinated. Enclosed find statement from superintendent of public school. The parochial school has about 180 to 200 pupils enrolled, with about the same proportion of unvaccinated children.

We have held twelve meetings during the year. Expenses for year \$112.30.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 1 case; scarlet fever, 3 cases; typhoid fever, 6 cases; measles, 67 cases.

ELYRIA, LORAIN COUNTY

Dr. Wm. E. Hart, health officer.

Population, between 10,000 and 12,000.

Our streets and alleys are in good condition. Our board does not look after the streets, but they attend to the alleys.

We have some trouble with sewerage. We have a dumping ground and our scavenger attends to all night soil.

All contagious diseases are not reported. The board has never kept a record. Physicians are good in reporting measles, diphtheria and scarlet fever—but very bad in reporting chicken-pox, tonsillitis, typhoid fever, etc.

Not over one hundred vaccinations the past year—perhaps one hundred and fifty.

Large per cent of unvaccinated children at school. Our board met every month and sometimes oftener.

Our sanitary policeman receives \$1.50 per day when working. His salary is paid out of sanitary fund and averages about \$36 per month.

The health officer is paid the large sum of one hundred and fifty dollars per year.

The board has aided in stopping the very offensive odor from the linseed oil works. We have a very good mem-

bership on our board, but a little too close in money matters to do very much good.

From our sanitary policeman I learn that in 1899 we had 35 cases of scarlet fever—no deaths—9 cases of diphtheria and one death.

From conversation with other physicians, I think we had about thirty cases of typhoid fever. Any amount of chicken-pox. A few cases of whooping cough. Three or four deaths from typhoid fever. From one of our best physicians I learn that he has had two cases of chicken-pox very closely resembling small-pox.

We use a formaldehyde generator for fumigation after scarlet fever—good results.

Infectious diseases reported during the year, estimated: Diphtheria, 9 cases; membranous croup, 2 cases; scarlet fever, 35 cases, typhoid fever, 30 cases; whooping cough, do not know, measles, 2 cases.

FAIRPORT, LAKE COUNTY.

A. J. McCue, health officer.

Population, 1,500.

Our streets, alleys and yards are in a cleanly condition. Night soil is removed at night in a wagon.

The board of health meets once every month. One prosecution was brought by the board and the defendant fined.

FAIRVIEW, GUERNSEY COUNTY.

Dr. F. H. Lane, health officer.

Population (estimated), 500.

There was only one meeting of our board during the year. The board was reorganized and I was elected health officer.

The alleys and lots are inspected two or three times a year and when anything is found in bad order it is ordered cleaned up.

The town being on high ground there is good natural drainage. The health-

ful location accounts for the small amount of sickness.

Water closets are all built over vaults and when full they are usually covered and the building moved.

Contagious diseases are quarantined.

No cases vaccinated during the year.

Infectious diseases reported during the year: Typhoid fever, 1 case.

FAYETTE, FULTON COUNTY.

W. O. Ford, health officer.

Population, 1,000.

Streets, alleys and yards are in good condition. There is no cause for complaint on account of lack of sewerage or improper discharge of sewage. Night soil is removed twice a year by sanitary man.

Contagious diseases are not properly reported, but a record is kept of such as are. Restrictive measures have been enforced. Whooping cough has been more prevalent than usual. There are one hundred and fifty-three unvaccinated children attending the public schools.

The board held two meetings and expended \$5.00.

Infectious diseases reported during the year: Scarlet fever, 1 case; measles, 2 cases.

FAYETTEVILLE, BROWN COUNTY.

Edward Hanum, health officer.

Population (estimated), from 350 to 375.

The streets, alleys and yards of the village are all in good condition and there is no cause for complaint from the lack of sewerage or from any improper discharge of sewage.

No arrangements are made for the removal of garbage by the corporation, but the citizens never fail to haul such stuff away in wheelbarrows and wagons.

We do not keep a record of contagious diseases but they are always promptly attended to. Diphtheria has

been the most prevalent of the contagious diseases, there having been one case, and none of measles, mumps, etc.

At your request have visited public school and ascertained that nineteen of the pupils have not been vaccinated within the past year.

Also St. Patrick's Academy, there being thirty-three delinquent at that institution.

As we have no board of health of course there have been no meetings of same and consequently no money expended and no prosecutions brought for violations of health laws.

Have not been able to ascertain number of grown people who have been vaccinated within the last year, but do not believe there are any who have, it really not being necessary, there being no pestilence or infection in the community.

Infectious diseases reported during the year: Diphtheria, 1 case (doubtful).

FELICITY, CLERMONT COUNTY.

C. B. Altman, health officer.

Population (estimated), 900.

Sanitary conditions are good. Contagious diseases are properly reported, and a record is kept. Number vaccinated during the year, 100; number of meetings held during year, 2; total amount spent by board of health, \$27.

Infectious diseases reported during the year: Diphtheria, 1 case; whooping cough, 20 cases.

FERN BANK, HAMILTON COUNTY.

James E. Hickman, health officer.

Population (estimated), about 350 to 400.

Our board of health has not met for over one year. I was appointed by the mayor of the village of Fern Bank, O. Streets, alleys and yards are in good

condition. There have been no arrangements made for night soil or garbage.

Contagious diseases are not properly reported and no record kept of them. Measles have been more prevalent than the others. There have been no meetings of the board of health during the year. No expenses whatever.

Infectious diseases reported during the year, 20 cases.

FINDLAY, HANCOCK COUNTY.

Amos Beardsley, health officer.

Population (estimated), 20,000.

Streets, alleys and yards are in good condition. There is much cause for complaint from lack of sewerage and from improper place of discharge of same in south part of city. The board has successfully abated all nuisances undertaken. Night soil is removed outside the city limits and plowed under. Garbage is cremated. Contagious diseases are properly reported. A record is kept. Proper restrictions have been enforced. Measles has been more prevalent than usual. About 3,500 persons have been vaccinated the past year. About 500 unvaccinated children attend school.

The board held 41 meetings in 1899. The total amount expended during the year was \$3,945.35, \$950.63 of which was for care of smallpox. Two prosecutions were brought by the board, one against a physician for failing to report a case of scarlet fever in which the board failed; one for disobedience of order to abate a nuisance, in which the board was successful.

Infectious diseases reported during the year: Diphtheria, 33 cases; membranous croup, 3 cases; scarlet fever, 108 cases; typhoid fever, 29 cases; smallpox, 1 case; whooping cough, 4 cases; measles, 372 cases; measles, German, 86 cases; other infectious diseases, chickenpox, 20 cases.

FLUSHING, BELMONT COUNTY.

Dr. A. B. Hobson, health officer.

Population (estimated), 750.

I believe the sanitary condition of our village is as good as we can make it. Contagious diseases are reported and necessary precautions are taken to prevent spread of same. No meetings of health board.

Infectious diseases reported during the year: Scarlet fever, 3 cases.

FOREST, HARDIN COUNTY.

Dr. W. T. Gemmill, health officer.

Population (estimated), 1,500.

We have a regularly organized board of health with a health officer and a sanitary policeman who looks after the sanitary condition of streets, alleys, buildings, etc., as required by law.

The streets and alleys of the village are kept in a fairly good condition, being cleaned as often as necessary. We have no system of sewerage, except for storm water and that not very good. Have had no prosecutions for violation of law regarding the abatement of nuisances, but had a little trouble with one butcher who insisted upon butchering in his building in the rear of his shop, but the matter has been settled without prosecution.

We have no system about the removal and disposal of night soil, but it is generally carted out of town and buried where permission is given to do so and care is taken that it be not within reach of any wells or water supplies.

Contagious diseases are quite well reported and quarantine is usually enforced without much opposition. Measles and whooping cough are not always reported, but we have had no epidemics of these diseases. Vaccination has been quite general among adults and school children. The board of health holds four or five meetings during the year, or more if there is any business needing their attention.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 15 cases; typhoid fever, 5 cases; whooping cough, 20 cases.

FOSTORIA, SENECA COUNTY.

William N. Caldwell, health officer.

Population (estimated), 9,000.

Sanitary condition is good. Contagious diseases are promptly reported. The board has had no trouble whatever. Scarlet fever has been more prevalent than usual. There were about 1,000 persons vaccinated. About 200 unvaccinated children. The board of health has had 13 meetings during the year. Total amount expended by the board, \$1,200. No prosecutions by board.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 1 case; scarlet fever, 23 cases; typhoid fever, 31 cases; smallpox, 2 cases; whooping cough, 6 cases; measles, 7 cases.

FRANKLIN, WARREN COUNTY.

Dr. D. A. Williams, health officer.

Population (estimated), 3,000.

We have as best we could kept our little town in good sanitary condition. Just how much we have expended I don't know, as secretary has that report. We have met things as they came up and have kept the town in a good sanitary condition.

Last winter some 600 or 700 were vaccinated in this locality.

We aim to meet once every month, but miss once in a while.

We have two doctors here who would ignore the board of health if they dared, but we go right on doing the things we think best.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 1 case; scarlet fever, 12 cases; smallpox, 7 cases.

FRAZEYSBURG, MUSKINGUM COUNTY.

Wm. Host, health officer.

Population (estimated), 800.

Expenses last year \$7.00. Board of health met twice. Lots and alleys are in as good condition as could be expected this time of year.

FREDERICKSBURG, WAYNE COUNTY.

Dr. D. P. Shie, health officer.

Population (estimated), 900.

Sanitary conditions excellent. Have maintained an active organization of the board of health.

Proper measures have been successfully enforced for the prevention of contagious diseases. But have a few nuisances to contend with, viz.: A creamery and slaughter house on Salt Creek above the village, the filth and refuse from which is directed into said Salt creek which flows through the village.

All contagious diseases are promptly reported and quarantine regulations established. Smallpox was more prevalent here than usual, however we have none now and fear no outbreak because of the fact that everybody great and small was vaccinated last spring. There were probably a thousand people vaccinated.

By an order from school board no child is permitted to attend our public school who has not been vaccinated within the year 1899.

There have been ten meetings of the board of health in 1899. Total amount expended, \$277.44. There have been no prosecutions.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 3 cases; typhoid fever, 10 cases; smallpox, 26 cases; measles, 4 cases.

FREDERICKTOWN, KNOX COUNTY.

Dr. W. W. Pennell, health officer.

Population (estimated), 1,000.

Our village is in good sanitary condition. The health board is in active operation and has been successful in the measures to prevent contagious diseases.

Contagious diseases are properly reported. Scarlet fever has been the only contagious disease with which we have had to deal in last years. The board has held but three or four meetings and has paid out nothing.

Infectious diseases reported during the year: Scarlet fever, 5 cases.

FULTONHAM, MUSKINGUM COUNTY.

Dr. C. B. Moore, health officer.

Population (estimated), 300.

Six privy vaults cleaned, four hog pens cleaned, weeds kept mowed down, Everything in good shape. School children all vaccinated.

Infectious diseases reported during the year: Whooping cough, 15 cases; measles, 21 cases.

GALION, CRAWFORD COUNTY.

Dr. H. H. Hartman, health officer.

Population (estimated), 8,000.

Our streets, alleys and yards are in a cleanly condition.

City only partially sewerred. The board of health I trust will succeed in having the city entirely sewerred, using the filtration system.

Scarlet fever has been most prevalent. Contagious diseases are reported promptly.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 48 cases; small-pox, 3 cases; other infectious diseases, 3 cases.

GALLIPOLIS, GALLIA COUNTY.

Dr. James Johnston, health officer.

Population (estimated), 6,500.

The present sanitary condition of our city is good. Our board of health is in active operation and enforces proper measures for the prevention of contagious diseases. Streets, alleys and yards are in a cleanly condition except mud on the streets at present time.

Contagious diseases are properly reported but no record kept except those who die. There is no nuisance of any kind in the city. Small-pox more prevalent than in former years, but no deaths.

There has probably been three hundred persons vaccinated in the last year.

There has been six meetings of the board of health in the last year.

The amount spent by the board in the last year was \$924. There was no prosecutions.

There was no record kept of infectious diseases reported except those who died.

GENEVA, ASHTABULA COUNTY.

Dr. F. C. Smith, health officer.

Population (estimated), 3,200.

Streets, alleys, and village in general is in a cleanly condition. We have no system of sewerage, therefore we have considerable trouble with drains from houses, etc., to know what to do with it. Most of our nuisances are successfully abated with little trouble. Night soil is removed at night, in a tight wagon by one man, he also carts away all garbage.

Contagious diseases are fairly well reported, and we enforce strict quarantine measures.

A record of all cases is kept. Measles and diphtheria have been the most prevalent the last year.

About 25% of public school children are not vaccinated.

No prosecutions have been brought by the board during 1899. Board held nine meetings during the year 1899.

Money spent by board \$186.25.

Infectious diseases reported during the year: Diphtheria, 18 cases; membranous croup, 2 cases; measles, 75 cases.

GEORGETOWN, BROWN COUNTY.

H. P. Shelton, health officer.

Population (estimated), 2,000.

The streets, alleys and yards are in a very good condition, during heavy rains sometimes water accumulates for a short while on the side of a few streets, although drainage is fair.

No nuisances the board has been unable to abate. Night soil and garbage removed weekly.

We have had scarlet fever in a very light form and some cases have not been reported, as there was no attending physician, so it has been impossible to stamp it out entirely. Restrictive measures not enforced by board but by myself without much trouble.

Scarlet fever, varicella and whooping cough more prevalent than usual.

Three hundred, more or less, unvaccinated children attending school.

The board held three meetings, but spent no money.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 12 cases; typhoid fever, 2 cases; whooping cough, several; other infectious diseases, varicella, a large number.

GERMANTOWN, MONTGOMERY COUNTY.

William Schaeffer, health officer.

Population (estimated), 2,000.

Our streets, alleys and yards are in a cleanly condition.

We furnish a horse and wagon, and employ a man by the year to remove all rubbish and nuisances as they accumulate. Our sewerage is good and there is no cause for complaint.

The removal of night soil is done after 11 o'clock at night, in a closed tank.

There has been no nuisances during the year, but what have been successfully removed. All vaults were inspected and disinfected. We also inspected the dairies, which were found in an excellent condition.

All contagious diseases have been properly reported, and a record of same kept and the board enforced the proper restrictions in all contagious diseases.

Infectious diseases have been less numerous this year than usual.

The number of persons vaccinated during the year did not exceed seven or eight.

The number of unvaccinated attending school according to the Superintendent's report is 182.

The board has held eight meetings during the year. Total amount spent by board for the year was six hundred dollars (\$600.00).

There has been no prosecution for violation, all orders and laws having been complied with.

Infectious diseases reported during the year: Typhoid fever, 7 cases; whooping cough, 2 cases; measles, 1 case.

GETTYSBURG, DARKE COUNTY.

I. B. Miller, member of Council, health officer.

Population (estimated), 400.

The sanitary condition is as good as could be expected to have it. We have no regular organized board of health. Only by agreement. The council is expected to look after the sanitary affairs of the town and to look after quarantining—should it be necessary. We have had no contagious diseases in our village during the past year. But very little sickness of any kind and only three deaths.

GIRARD, TRUMBULL COUNTY.

Dr. D. R. Williams, health officer.

Population (estimated), 3,000.

Streets, alleys and yards are in a very fair condition as to cleanliness. There

has been no cause for complaint from lack of sewerage or from an improper discharge of sewage during the last year.

We have successfully abated all nuisances. A scavenger is appointed by the board for one year, with whom a contract is made to remove all night soil between the hours of 10 P. M., and 4 A. M., in a suitable watertight box. Scavenger is under \$100 bond to perform his work to the satisfaction of the board. No arrangement is made for the disposition of garbage.

Contagious diseases are reported and a record of same is filed. Village has been unusually free from contagious diseases during the year.

Number of children attending school vaccinated is 77, unvaccinated 480. Vaccinated during the year 30. About 60 persons have been vaccinated during the year.

Thirteen (13) meetings have been held during the year. Total amount spent for the year is \$258.68.

No prosecutions were made.

Infectious diseases reported during the year: Diphtheria, 3 cases; typhoid fever, 4 cases; measles, 1 case.

GLENDALE, HAMILTON COUNTY.

Clifford Allen, health officer.

Population (estimated), 1,440.

Streets, alleys and yards clean.

Sewerage good.

No nuisances. Night soil removed in properly constructed cart and dumped on farm outside of village.

Contagious diseases are promptly reported and record kept. Board has had no trouble in enforcing all regulations.

No unvaccinated children are permitted to attend school.

Board meets once a month.

Amount spent by Board \$126.00.

No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 3 cases; measles, 3 cases.

GLENVILLE, CUYAHOGA COUNTY.

Andrew H. Carr, health officer.

Population (estimated), 6,000.

The sanitary condition has been greatly improved since the construction of a system of sewerage which has been extended through the central and most thickly populated portion of our village, the outlying portions are still compelled to make use of cesspools, but it is hoped that the sewer district will before long be extended so as to afford relief in this section of the village.

Night soil is collected by a scavenger, who removes it to farm land out of town where it is buried.

All contagious diseases are properly reported and a record of them is kept.

Contagious diseases have not been more prevalent this past year than usual, with the exception of small-pox. Four cases of this disease having occurred in the newly acquired easterly portion of the village, and these cases were traceable to exposure in shops in the city of (Cleveland) until this past year no other case of small-pox had occurred in the village for ten years.

About 75 persons were vaccinated during the past year. About one-half of the school children are vaccinated.

Regular meetings of the health board are held twice a month during the spring and summer season, and once a month during the winter time.

There has been no violation of health board laws of sufficient magnitude to necessitate legal proceeding.

In carrying out quarantine regulations in the small-pox cases the board expended \$275.00.

Infectious diseases reported during the year: Diphtheria, 6 cases; scarlet fever, 25 cases; typhoid fever, 8 cases; small-pox, 3 cases; whooping cough, 30 cases; measles, 15 cases.

GLOUSTER, ATHENS COUNTY.

Dr. J. M. Rhodes, health officer.

Population (estimated), 4,000.

Streets and alleys very filthy. There is no sewerage to speak of. The board

has tried to abate nuisances, but the Council would make no appropriations.

No arrangement for removal of night soil and garbage.

Contagious diseases not reported by physicians, no records kept.

Have had some cleaning up by best of citizens, but not of general character.

Four meetings of board of health were held during the year.

Total spent \$65.00. There has been no prosecutions.

About 200 children out of 800 not vaccinated.

Infectious diseases reported during the year: Diphtheria, 2 cases.

GNADENHUTTEN, TUSCARAWAS COUNTY.

Dr. B. F. Coen, health officer.

Population about 600.

We have no regularly organized board of health and of course no health officer. I will fill the blank as best I can from memory.

Streets and alleys clean. We have good natural drainage, but no sewers. Have had no nuisances. Garbage is hauled to the country. Have had no vaccinations.

Infectious diseases reported during the year: Typhoid fever, 5 cases; whooping cough, 3 cases.

GRAND RAPIDS, WOOD COUNTY.

Wm Mailey, health officer.

Population (estimated), 600.

Sanitary condition good. Board of health attends promptly to complaints and looks after the general condition of affairs.

All contagious diseases reported except chicken-pox and whooping cough.

School superintendent reports 111 pupils in school not vaccinated. Some 18 are foreign scholars.

GREEN CAMP, MARION COUNTY.

W. C. Knickle, health officer.

Population (estimated), 400.

This village has been in good condition. All diseases have been properly reported. There were no persons vaccinated the last year.

Total amount spent by board of health, \$8.00.

There were no prosecutions.

The board held one meeting.

Infectious diseases reported during the year: Scarlet fever, 5 cases; whooping cough, 25 cases.

GREENSPRING, SENECA COUNTY.

Dr. H. L. S. Hinkly, health officer.

Population (estimated), 1,200.

I think the sanitary condition good. Sewerage fair, the health officer with inspecting committee have successfully handled all nuisances. For two years we have had a dump pit for refuse. Night soil has generally been buried, but we have been able to get a part of it drawn out of town.

All diseases are reported and a record kept. All measures have been enforced. No contagious diseases to speak of, not a person vaccinated to my knowledge. About one-third unvaccinated as near as I can ascertain or about 50.

The board has held 4 or 5 regular meetings, but when it has been necessary have had called meetings to the number of 6 or 8.

The amount spent has been about \$35, \$25 of which the health officer received.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 1 case.

GREENVILLE, DARKE COUNTY.

Dr. John D. Kerlin, health officer.

Population (estimated), 6,500.

Our city is badly in need of a good system of sewerage but our council has recently had an election in which the

vote in favor of sewerage passed, so I think next year we will get what we need. We have had no trouble in carrying out the wishes of the local board of health.

All contagious diseases are promptly reported and strict quarantine measures taken without any trouble. Vaccination until the last month has been rare, we are doing better now. Number of children attending school unvaccinated about 250.

Our board meets once a month.

Have had no prosecutions or trouble whatever.

Expense of our board is about \$300 per year.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 4 cases; typhoid fever, not reported.

GREENWICH, HURON COUNTY.

O. L. Sisson, health officer.

Population (estimated), 1,200.

Sanitary condition good. No contagious diseases.

Board of health held three meetings in past year

HAMLER, HENRY COUNTY.

N. J. Blihn, health officer.

Population (estimated), 800.

Our board meets once a month unless it is a special meeting. Our village is in a very fair condition.

Night soil is carted out of the village and buried.

Diphtheria and scarlet fever very light Diseases properly reported.

Haven't had any prosecutions the last year. I don't know just the amount of money spent, the secretary is out of town for a few days.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 11 cases; whooping cough, 8 cases.

HANGING ROCK, LAWRENCE COUNTY.

Joseph Kinkaid, health officer.

Population (estimated), 550.

The present sanitary condition of our village is good. The board has been successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances.

Streets, alleys, and yards in a clean condition. There is no cause of complaint from the lack of sewerage. There is no nuisance which the board unsuccessfully tried to abate.

Contagious diseases are not properly reported.

Number of persons vaccinated during the year, 109. Number of unvaccinated children attending public school, 38.

Number of meetings held by the board during the year, 15.

Amount spent by board during the year \$87.00. No prosecutions brought during the year.

Infectious diseases reported during the year: Typhoid fever, 5 cases; measles, 12 cases.

HARTWELL, HAMILTON COUNTY.

Dr. O. W. Butler, health officer.

Population (estimated), 2,000.

Sanitary condition is good. Streets, alleys and yards are in general clean and well kept. No complaint from lack of sewerage.

The board has called the attention of Council to an open ditch along tracks of the C. H. & D. R. R., on Burns Ave., recommending that steps be taken to have same closed. This is a matter that the board has tried more than once, in years past, to have remedied, but as yet nothing has been done.

Night soil is removed by wagon between the hours of 11 and 3 at night.

Contagious diseases are promptly reported and a record of them is kept. There has been no trouble recently about enforcing the proper restrictive measures. Only three were reported during the year—two of diphtheria and one of

scarlet fever. Very few have been vaccinated during the year, owing to the fact that nearly all unvaccinated persons were vaccinated during Nov. and Dec. of 1898.

A very small proportion of children attending public school has not been vaccinated.

The board of health has regular meetings on the second Thursday in each month; sometimes a majority of the members are not present, but the health officer and clerk have been regular, and ready to call special meetings if necessary.

There has been no expenditures by the board except for salaries of health officer and clerk—\$150.00.

No prosecutions brought by the board.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever 1 case.

HARVEYSBURG, WARREN COUNTY.

Dr. J. E. Witham, health officer.

Population (estimated), 500.

The organization of our health board was never completed. Streets and alleys are in fair condition for a small village.

Nuisances have been reported to health committee of Council and abated.

Contagious diseases have been reported to health committee of town Council and quarantined. No record of diseases is kept. Do not think any vaccination was done in our village last year, at most, not more than three or four children.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 1 case; typhoid fever, 6 cases; measles, don't know.

HICKSVILLE, DEFIANCE COUNTY.

B. L. Kelsey, health officer.

Population (estimated), 3,000.

The board held five meetings and at present is in good working order. Al-

leys, streets and yards are in fairly good sanitary condition. At present we have no infectious disease.

The board was successful in all its undertakings except the sewerage of one public water-way. Have had several hitches with the council. Do not know if we will succeed or not. You may hear from it later.

Infectious diseases reported during the year: Typhoid fever, 3 cases.

HILLSBORO, HIGHLAND COUNTY.

Dr. S. R. Howard, health officer.

Population (estimated), 5,000.

Our B. of H. has maintained an active organization.

Our streets and alleys are comparatively clean.

There is good cause for complaint from an improper discharge of a county sewer in corporation limits.

Sixty per cent. of our school children have been vaccinated.

Have no particular system of disposing of night soil.

Contagious diseases are properly reported and records of same kept.

Board has held fifteen meetings during year.

Board has expended \$230.69 during year ending March 1, 1900.

HOLGATE, HENRY COUNTY.

B. W. Justus, health officer.

Population (estimated), 1,300.

Our alleys and streets are in a fair condition. We can manage that, but there are two outlets to our sewers, School Creek and Township Line ditch; the former runs through the west side of our town and is a filthy thing. Two or three hundred privies and barns drain into it and one butcher shop dumps the greater part of its refuse into it, and other filth that is dumped into it makes it a dangerous and filthy place

in warm weather and, I am told, has been the cause of a number of cases of typhoid fever, of which some proved fatal.

The Township Line ditch is the outlet to the northeast quarter of the town and a number of privies and barns drain into it. It is so badly filled up that the water stands in it and dries up and is a dangerous and filthy place. I called the attention of the council to it. They said they had nothing to do with it and no steps were taken to abate the nuisance.

The night soil is taken away by men that work at that business.

I have no record of contagious diseases as I have only served as health officer six months. The board has had only one meeting since I have served.

One more thing, it is impossible to get the B. & O. Railroad Co. to remove dead carcasses of animals that they kill inside of the city limits. Sometimes they bury them at the side of the track with only a few inches of dirt over them.

HOLMESVILLE, HOLMES COUNTY.

Dr. Edgar Cole, health officer.

Population (estimated), 400.

Streets, alleys and yards are not in a cleanly condition. There is no cause of complaint from lack of sewerage, or from an improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage is buried or burned.

Contagious diseases are properly reported and a record kept. The board has been able to enforce restrictive measures. No contagious diseases this year. No one vaccinated this year. School children are nearly all vaccinated. There have been four meetings of the board of health in 1899, two regular and two called. The total amount spent by board of health was twenty dollars (\$20.00). No prosecutions this year.

HOPEDALE, HARRISON COUNTY.

Dr. L. A. Crawford, health officer.
Population (estimated), 600.

Our village is in very good shape and were anything to come up I would notify State Board, just the same as though we had a local board here.

Not one child was vaccinated during last year.

About twenty pupils in schools are not vaccinated.

No meeting of board last year. Not one cent spent by board.

Infectious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 6 cases; typhoid fever, 15 cases; whooping cough, 25 cases.

HUDSON, SUMMIT COUNTY.

Dr. G. L. Starr, health officer.
Population (estimated), 1,100.

The board of health in our village has sustained the health officer and sanitary policeman in all efforts to keep the town clean. Our streets and alleys are in good condition. Sewerage is ample and with one or two exceptions the disposal of sewage has been attended to in accordance with rules established by the board — by distribution upon the surface of the ground. Pig-pens in a few instances were likely to become nuisances, but extra care and cleanliness, aided by the dry season, and removal in some instances, reduced complaint to nil. Another season may witness their banishment from our village. An exception to proper disposal of slops caused some trouble, but has been finally accomplished according to rule. A cesspit was being dug on premises newly occupied, but was, by order of health officer, filled without being used. Night soil is usually removed between sundown and next morning, and no complaint as to removal or disposition, as it is deposited on lands outside corporation lines and away from human habitations, with consent of the owners. Garbage has found location where it will not prove a nuisance.

As a rule, contagious diseases have been promptly reported, names of those affected obtained from attending physicians and teachers in the schools, and the same entered upon health officer's memorandum book. Quarantine has been maintained in threatening cases of contagious or infectious disease. A few cases of whooping cough, chickenpox and mumps have occurred during the past year, the last named is being guarded at present. Vaccination is unpopular, but in my opinion, ought to be made compulsory. More than half the pupils of the public school are unvaccinated, according to report of Superintendent Randolph. A score or more may have been vaccinated. There are probably towards two hundred that are unscarred.

Nine or ten meetings of the board have been held. Amount spent would not exceed thirty dollars beside pay of officials — \$100 at the outside. There have been 1 case of scarlet fever, 2 of whooping cough, 2 of chickenpox and about 13 of mumps to date. No prosecutions have been made. Our health rate has been above the usual mark.

Infectious diseases reported during the year: Scarlet fever, 1 case; whooping cough, 2 cases; other infectious diseases, 16 cases.

HUNTSVILLE, LOGAN COUNTY.

Dr. J. S. Montgomery, health officer.
Population (estimated), 700.

This has been an unusually healthy year in this county. The sanitary condition of town good.

Infectious diseases reported during the year: Scarlet fever, 14 cases; typhoid fever, 3 cases.

HURON, ERIE COUNTY.

S. N. Lennon, health officer.
Population (estimated), 1,800.

The total expense incurred by the board of health for the year 1899, were \$215.71. This expense includes health

officer's and clerk's salary, free anti-toxine and cultures taken in diphtheria cases. Our board requires cultures taken, and those cultures must be free of germs before the quarantine is raised. Also the maintenance of the family while under quarantine.

Total number of children in school not vaccinated, 70; total number vaccinated in the past year, 15.

Infectious diseases reported during the year: Diphtheria, 24 cases; scarlet fever, 10 cases.

HYDE PARK, HAMILTON COUNTY.

Dr. John Lewin McLeish, health officer.

Population (estimated), 1,800.

Owing to the proximity of Hyde Park to Cincinnati, our village is favored with all the improvements of a large city, and as a result, the streets, alleys and yards are maintained in excellent condition, from a sanitary and hygienic standpoint. During the hot months of last year there were some complaints as to accumulation of sewage gas and consequent disagreeable odors in the main conduits, but this was obviated by bi-weekly flushing of the mains and employment of disinfectants.

As yet we have no organized system for disposal of garbage, but our residents are recommended to burn same where practicable.

While the reports of contagious diseases are not always as prompt as we might desire, still every effort is made to enforce such reports and a village record is kept. Proper restrictive measures are always enforced. Scarletina has been very prevalent in our community during the past few months.

As our school here is under the regime of the Cincinnati authorities, your question relative to vaccination comes under the province of the city health officer.

I believe I reported the efforts of our board to suppress expectoration upon sidewalks and within public buildings,

and to disseminate a wider knowledge of tuberculosis and precautionary measures in relation thereto, and our efforts in this direction have been fairly successful. Copies of the enclosed circular were distributed through our corporation, and weekly articles on Sanitation and Hygiene, compiled by resident physicians of the village, distributed under the supervision of the board and published in the village papers.

Our board meets on the first Monday of each month, and the attendance during the past year has been very good. The Sanitary Fund of the village is \$276 per annum, and our expenses have been kept within this limit since the inchoation of the board. We have had no occasion to undertake any prosecutions as yet, as our community consists of a representative suburban population of the better classes and are very thoroughly amenable to our regulations. It is the desire of our board to co-operate with the State Board in every way possible and to that end we solicit correspondence on matters of mutual interest.

IRONTON, LAWRENCE COUNTY.

Dr. E. E. Wells, health officer.

Population (estimated), 15,000.

Streets, alleys and yards are in as fair condition as we can expect. Some streets are not paved, therefore we have an abundance of mud as the result. The board of health has been successful in abating all nuisances it has undertaken and has used rigid means in stamping out smallpox. Has spent during the year about \$4,000.

This disease has caused a great many called meetings and besides these the board held its regular meetings once a month. We had one prosecution for breaking quarantine rules. Our sewerage system does not reach the entire city. In a majority of cases vaults (60 feet in depth) are used for night soil.

Garbage carts remove garbage to dumping ground.

Something like 1,200 have been vaccinated during the year. I am of the

opinion that all cases of smallpox, diphtheria, scarlet fever and other contagious and infectious diseases have been reported with the exception of measles, as in most all of these cases a physician's services were not called for.

Infectious diseases reported during the year: Diphtheria, 20 cases; scarlet fever, 2 cases; typhoid fever, 46 cases; smallpox, 14 cases; whooping cough, 1 case; measles, 5 cases.

JACKSON, JACKSON COUNTY.

Henry Simmers, health officer.

Population (estimated), 6,500.

The streets, alleys and yards are in good condition. No cause of complaint from lack of sewerage. No nuisances that have not been abated.

The removal of night soil is in tank-wagon and water-tight barrels to a farm outside city limits.

Contagious diseases are properly reported — a record of such diseases is kept. The board has been able to enforce proper restrictive measures. Diphtheria, croup and measles have been most prevalent. No one vaccinated during the year. There are 650 unvaccinated children in our schools.

The board has had twelve meetings during the year. Total amount expended for disinfectants, salaries, stationery, burying dead animals, \$200.28.

There have been no prosecutions brought by the board during the year.

Infectious diseases reported during the year: Diphtheria, 8 cases; membranous croup, 2 cases; measles, 11 cases.

JACKSONVILLE, ATHENS COUNTY.

John Stamm, health officer.

Population (estimated), 1,000.

Sanitary conditions are good.

The board has maintained an active organization.

It has been successful in enforcing proper measures for the prevention of

contagious diseases and abatement of nuisances.

All streets, alleys and yards are kept fairly clean.

No complaint from lack of sewerage.

The city has a contract with a certain party for dumping ground, the same person cleans vaults at his own price. It is optional with the people whether they employ him or some one else.

Contagious diseases are all reported; a record of same is kept. We have been able to enforce proper restrictive measures.

Typhoid fever has been the most prevalent of the infectious diseases.

Not one has been vaccinated during the year.

Number of meetings, 17.

Total amount spent, \$31.00.

Two prosecutions were brought by board for burying horses within corporation limits. Board was successful.

Infectious diseases reported during the year: Diphtheria, 1 case; membranous croup, 1 case; typhoid fever, 5 cases.

JENERA, HANCOCK COUNTY.

C. H. Heldman, health officer.

Population (estimated), 300.

Quarantine measures have been enforced in contagious diseases. Five meetings were held by the board, and \$53.00 was expended.

Infectious diseases reported during the year: Diphtheria, 5 cases; typhoid fever, 1 case; whooping cough, 1 case; chickenpox, 14 cases.

JERSEY, LICKING COUNTY.

Dr. S. S. Richards, health officer.

Population (estimated), 155.

No special meetings. Spent ten dollars for fumigating. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 1 case; whooping cough, 20 cases; measles, 3 cases.

JEWETT, HARRISON COUNTY.

Isaiah McMannis, health officer.

Population (estimated), —.

Our village is in a moderately good sanitary condition. But it could be improved; hope it will next year. The board of health has not met but once since the last organization. They depend on the health officer to do it all.

Our sewerage is all in good condition, but need more, which we will have ere long.

JUNCTION CITY, PERRY COUNTY.

Dr. P. A. Gordon, health officer.

Population (estimated), 350.

During the year of 1899 had very few cases of zymotic diseases except measles. Measles was epidemic during the early fall months. No deaths. Two cases of scarlatina, mild. No deaths.

Infectious diseases reported during the year: Scarlet fever, 2 cases; measles, number not reported, estimated 60 cases

KELLY'S ISLAND, ERIE COUNTY.

Henry Elfers, health officer.

Population, (estimated), 1,300.

Streets, alleys and yards are in good condition, but there is some complaint in regard to lack of sewerage. Night soil is removed to farms.

Contagious diseases are reported and a record kept. Restrictive measures are enforced. About thirty persons have been vaccinated.

The board held sixteen meetings. Amount expended, \$30.00.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 3 cases; small-pox, 1 case.

KENT, PORTAGE COUNTY.

L. G. Reed, health officer.

Population (estimated), 5,000.

Our village is considered to be in very good sanitary condition. We try to keep our streets, alleys and public places clean. Our board met last year about 5 or 6 times with good attendance. Our greatest need is a system of public sewerage. Nearly all new buildings erected within the past 5 years are arranged with bath and kitchen sink, many of them discharging into the streets. Our local sanitary rules prohibit water and slops of this nature being thrown or discharged onto streets, alleys, lanes or public grounds, but where houses are occupied by tenants as many of them are, it is next to impossible to enforce strict sanitary rules. As for myself I have been urging upon our City Council the necessity of sewerage. Some three or four months ago, they appointed a Committee to investigate the matter, with a view to taking definite action some time. The chairman of said committee Mr. J. B. Miller, informed me not long ago that he had written you concerning the matter. I think the object of his writing you was for the purpose of getting your opinion, or rather approval to discharge sewage into the Cuyahoga river below the dam, as they do not wish to go to the expense of a survey and getting up specifications, before knowing how they are going to dispose of it.

Contagious diseases are properly and promptly reported except typhoid fever, but that we have very little of. Diphtheria was a little more prevalent than usual, but nothing like an epidemic. As to vaccination, could give no estimate. There has been something done however.

No prosecutions for any cause.

Amount expended \$245.06. \$63.00 of amount was for getting up Sanitary Code. No special arrangement for disposing of night soil and garbage.

Infectious diseases reported during the year: Diphtheria, 11 cases; mem-

braneous croup, 2 cases; scarlet fever, 8 cases; typhoid fever, not reported; measles, 3 cases.

KENTON, HARDIN COUNTY.

F. H. Fall, health officer.

Population (estimated), 8,000.

No report.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 34 cases; typhoid fever, 7 cases.

KIMBOLTON, GUERNSEY COUNTY.

Dr. S. M. Mehaffey, health officer.

Population (estimated), 325.

Streets, alleys, yards etc. are fairly clean. No sewerage. Disposal of rubbish voluntary. Have not tried to abate any nuisances.

Contagious diseases are reported, but no record kept. No trouble in enforcing rules. No contagious disease more prevalent than usual. No vaccinations. Probably three-fourths of the children are not vaccinated.

No meetings. Spent nothing. No prosecutions.

Infectious diseases reported during the year: Typhoid fever, 5 cases.

KIRBY, WYANDOT COUNTY.

Dr. E. E. Burns, health officer.

Population (estimated), 175.

The sanitary conditions are pretty good. The sewerage is sufficient. We have no trouble with nuisances. Contagious diseases are reported and quarantined, and a record of such is kept.

Scarlet fever has been more prevalent than usual. No vaccinations during the year, and but very few school children have ever been vaccinated.

The board of health has met three or four times. Spent about \$10.00.

Infectious diseases reported during the year: Scarlet fever, 2 cases; whooping cough, 4 cases.

KOSSUTH, AUGLAIZE COUNTY.

Thos. J. Barnett, health officer.

Population (estimated), 200.

The present condition of village good. The board has maintained an active organization.

The board has been successful in enforcing measures for prevention of contagious diseases.

Infectious diseases reported during the year: Diphtheria, 4 cases.

LAKEWOOD, CUYAHOGA COUNTY.

Dr. A. E. McClure, health officer.

Population (estimated), 3,200.

The Hamlet trustees organized themselves into a board of health during the month of June 1900. They elected a president, secretary and health officer; and it is the intention of the board to meet quarterly.

We have carefully looked after contagious diseases and have had same properly quarantined; have had no trouble in enforcing the law.

We have now made a beginning towards a sewer system which you no doubt are already familiar with and I hope in a short time to have the hamlet properly sewered.

Infectious diseases reported during the year: Scarlet fever, 16 cases; typhoid fever, 3 cases; whooping cough, 5 cases; measles, 35 cases; other infectious diseases, 6 cases.

LANCASTER, FAIRFIELD COUNTY.

Dr. F. P. Stukey, health officer.

Population (estimated), 10,000.

The streets, alleys and yards in our city are kept in a very cleanly condition, but there is cause for complaint from the lack of sewerage, and also from an improper discharge of sewage. We are much in need of a sewerage system and it is to be hoped that our Council, can before long, bring about this most important improvement.

The board has been successful in abating all nuisances, except such as depended directly upon drainage or sewerage. We have no special arrangements for the removal of night soil and garbage, but we require the same to be removed sufficiently often so as not to become a nuisance.

Contagious diseases are promptly and properly reported, and a record of the same is kept. The board has been very successful in enforcing restrictive measures. Rubeola, varicella, and variola have been our most prevalent contagious diseases. There were about fifteen hundred children vaccinated during the year, and it is estimated that about three hundred unvaccinated children are attending the schools of the city.

The board held sixteen meetings during the year and expended \$1,883.74. Four hundred dollars of said amount was salary paid to physicians for treating the sick-poor of the city. There were four prosecutions, three, for a violation of the orders of the board in abating nuisances, and one, in failing to report a contagious disease. The first three resulted in conviction, and the fourth, owing to the absence, and not being able to learn the whereabouts of the principal witness, the case was withdrawn without prejudice.

Infectious diseases reported during the year: Diphtheria, 7 cases; membranous croup, 2 cases; scarlet fever, 11 cases; typhoid fever, 2 cases; smallpox, 24 cases; whooping cough, 8 cases; measles, 41 cases; other infectious diseases, varicella, 52 cases.

LA RUE, MARION COUNTY.

M. C. Long, health officer.

Population (estimated), 1,200.

No report.

Infectious diseases reported during the year: Typhoid fever, 1 case.

LAURELVILLE, HOCKING COUNTY.

J. S. Haynes, health officer.

Population (estimated), 600.

Streets, alleys and yards are in a cleanly condition, but there is cause for complaint in regard to sewerage. There is a tail race running through the village that contains filth of various kinds. It is in reality a receptacle for all the filth in town. Council refused to take proper action to abandon same. No arrangements are made for the disposal of night soil or garbage.

Contagious diseases are properly reported and a record is kept. Restrictive measures are enforced. Scarlet fever has been more prevalent than usual.

None of the school children have been vaccinated.

The board held six meetings and spent \$54.00. No prosecutions were brought.

Infectious diseases reported during the year: Scarlet fever, 10 cases; typhoid fever, 1 case; whooping cough, 1 case.

LEBANON WARREN COUNTY.

Dr. G. M. Curry, health officer.

The streets, alleys and yards of the village are in a fair condition of cleanliness. There was a complaint last summer on account of a creamery sewer which empties into a creek, and this may be renewed when warm weather returns.

No unsuccessful attempt has been made to abate a nuisance, except in regard to the sewage flowing away from said creamery.

Night soil is removed under the directions of the board of health and garbage by a scavenger who attends to it daily.

Contagious diseases are promptly reported, and a record made of the same. Scarlet fever is the only disease worthy of mention of a contagious nature occurring here last year. Can give no estimate in regard to vaccination.

The board of health met eight times in 1899. The total expenditure of the board for the year was \$85.89.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 4 cases; typhoid fever, 4 cases.

LEETONIA, COLUMBIANA COUNTY.

Dr. H. B. Kurtz, health officer.

Population (estimated), 3,500.

Streets, alleys and yards are in a cleanly condition. There is no complaint on account of sewerage. Night soil is removed by parties equipped for that purpose.

Contagious diseases are reported and a record kept. Restrictive measures are enforced. Typhoid fever has been more prevalent than usual. No vaccinations reported.

The board held eleven meetings and expended \$225.00

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 1 case; typhoid fever, 22 cases; whooping cough, 3 cases.

LEXINGTON, RICHLAND COUNTY.

Dr. H. H. Smith, health officer.

Population (estimated), 450.

There has not been regular meetings of the board of health. Meetings have been called during the year, when requested by the health officer. The drainage of our village is exceptionally good, owing to it being situated on a hillside. Streets and alleys are cleaned by street commissioner. Privy vaults are kept disinfected with chloride of lime by the marshal and health officer. The disinfectant being furnished by the board.

Still births have not been reported, I have no knowledge of any. There are about 50 children in school unvaccinated, the board is not unmindful of

them and in due time that will be attended to.

Contagious diseases are properly reported, but no record is kept. We have been able to enforce proper restrictive measures.

The board held three meetings during the year and expended, \$76.30.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 2 cases.

LIMA, ALLEN COUNTY.

Dr. L. F. Ludick, health officer.

Population (estimated), 30,000.

No report.

Infectious diseases reported during the year: Diphtheria, 14 cases; membranous croup, 1 case; scarlet fever, 118 cases; small-pox, 1 case; whooping cough, 2 cases; measles, 8 cases; other infectious diseases, chicken-pox, 6 cases.

LOCKINGTON, SHELBY COUNTY.

Jacob Everley, health officer.

Population (estimated), 212.

The present sanitary condition of our village is very fair. No complaints of streets, alleys and yards. All nuisances removed without any trouble. There has been no arrangement made as to the disposition of night soil and garbage.

Contagious diseases are properly reported and recorded.

There was no contagious disease except scarlet fever. Number of persons vaccinated about 8 or 10. Number attending school unvaccinated about 50.

The board of health I think had no regular meetings. Amount spent about \$15.00.

LOCKLAND, HAMILTON COUNTY.

Dr. B. H. Timberman, health officer.

Population (estimated), 3,500.

Streets, alleys and yards are in a fairly cleanly condition. There is some cause

for complaint both from lack of sewerage and improper discharge of sewage. The board has been unable to abate nuisances caused by hog pens. Satisfactory arrangements are made for the disposal of night soil and garbage.

Proper restrictive measures have been enforced in contagious diseases, which are reported and a record kept. Small-pox has been more prevalent than usual. There were about seventy persons vaccinated during the year.

Infectious diseases reported during the year: Scarlet fever, 3 cases; small-pox, 14 cases; measles, 4 cases.

LODI, MEDINA COUNTY.

Henry Selders, health officer.

Population (estimated), 900.

The sanitary condition is good. The board of health has maintained an active organization. The board has had no trouble in preventing contagious diseases and abating all nuisances.

Streets, alleys and yards are all in good clean condition.

Contagious diseases are promptly reported and a record is kept of same. Scarlet fever and small-pox have been more prevalent than usual. No vaccinations during past year.

The board of health has held twelve meetings during the year. The board has expended two hundred dollars (\$200) during the past year.

Infectious diseases reported during the year: Membranous croup, 2 cases; scarlet fever, 25 cases; typhoid fever, 1 case; small-pox, 2 cases.

LOGAN, HOCKING COUNTY.

Dr. N. H. Blosser, health officer.

Population (estimated), 3,000.

The sanitary condition of the town is good. Board maintains an active organization. Restrictive measures are enforced.

Contagious diseases as a rule are reported promptly and every thing under that head has been cared for.

Board met once. Total expended, \$347.48. No prosecutions were brought by the board.

Infectious diseases reported during the year: Diphtheria, 6 cases; scarlet fever, 23 cases; measles, 1 case; other infectious diseases, 18 cases.

LONDON, MADISON COUNTY.

Dr. M. Vance, health officer.

Population (estimated), 4,000.

Our place is in a very good sanitary condition. No fevers and no serious contagious or infectious diseases have been present.

Our physicians make no reports of births and deaths. As to sanitary matters our board is very diligent.

LORAIN, LORAIN COUNTY.

Dr. S. S. Cox, health officer.

Population (estimated), 16,600.

Streets are in fair condition.

Night soil is removed by contract at fifty cents per barrel, paid by owner of premises.

Garbage is removed during summer months at expense of city.

Contagious diseases are reported and have had no trouble in enforcing restrictive measures.

We have brought about 15 prosecutions for violations of rules prohibiting the burying of night soil and one or two for violating quarantine rules. All convicted and fined.

Infectious diseases reported during the year: Diphtheria, 13 cases; membranous croup, 1 case; scarlet fever, 22 cases; typhoid fever, 12 cases; small-pox, 3 cases; measles, 8 cases; other infectious diseases, 14 cases.

LOUDONVILLE, ASHLAND COUNTY.

Wm. Conrad, health officer.

Population (estimated), 1,600.

There were twelve meetings of the board in the year 1899. Many school

children are not vaccinated. Village is in good sanitary condition. Board expended \$92.00 during the year.

Infectious diseases reported during the year: Typhoid fever, 4 cases; other infectious diseases, 4 cases.

LOUISVILLE, STARK COUNTY.

Dr. C. A. Walker, health officer.

Population (estimated), 1,500.

The expenditures have been about (\$100) one hundred dollars.

The town is in good sanitary condition.

There have been but few children vaccinated. The majority of the school are not.

Typhoid fever has never been reported here.

Infectious diseases reported during the year: Diphtheria, 10 cases; membranous croup, 1 case; whooping cough, 10 cases; measles, 3 cases.

LOVELAND, CLERMONT COUNTY.

Dr. C. Haarlammert, health officer.

Population (estimated), 1,500.

There was no meeting of board of health until health officer discovered a case of small-pox in practice of another physician and which was not reported. Council and board of health then woke up and held a meeting. Health officer immediately instituted proper quarantine and the disease was confined to one building.

Streets and alleys not in very good sanitary condition.

There is considerable complaint (but none regularly made to health board) of stagnant surface water.

There is improper discharge of sewage. Two large sewers constructed by town discharge in the river which passes through center of town. Ice was taken from river for creamery and private ice

houses, and for shipment to Madisonville, just opposite sewers, and below several hog-pens on banks and 200 feet below where drain from closet from hotel empties into river. The board and town people are alike indifferent to these nuisances. No arrangements are made for removal of night soil and garbage. Vaults are required to be ten feet deep. West Loveland has gravel sub-soil and consequently drainage is not so essential, but East Loveland streets are now in filthy condition.

Contagious diseases are not reported. Health officer hunts them up when complaint is made.

Three cases of small-pox were found and properly quarantined. Duration of quarantine, between six and seven weeks.

Physicians have been notified to report contagious diseases, but do not obey. No record kept. No epidemic since July.

Five persons vaccinated.

Board of health held five meetings, then small-pox scare being over could not get them together again. Amount spent by board since July, \$165.00.

Infectious diseases reported during the year: Typhoid fever, 2 cases; small-pox, 3 cases; other infectious diseases, varicella, 2 cases.

LOWELL, WASHINGTON COUNTY.

Dr. Geo. A. Phillips, health officer.

Population (estimated), 378.

Streets, alleys and yards are in good condition with the exception of some manure piles in alleys. We have no sewerage system. No arrangements are made for the disposal of night soil or garbage.

There are a large number of unvaccinated children attending the public schools.

The board held only two or three meetings during the year.

LOWER SALEM, WASHINGTON COUNTY.

Dr. W. S. Williams, health officer.

Population (estimated), 300.

The streets, alleys and yards are kept in a fairly cleanly condition.

There is not enough of sewerage. Sewage is discharged into a creek.

There are no nuisances that we have had any trouble to abate except the keeping of hogs in the corporation.

The night soil is removed and buried.

We have had no contagious diseases during the past year.

The board holds no meetings. No money spent by the board.

No prosecutions brought during the year.

Infectious diseases reported during the year: Typhoid fever, 13 cases.

LYNCHBURG, HIGHLAND COUNTY.

C. A. Michael, health officer.

Population (estimated), 1,000.

Sanitary conditions of our village are fairly good. The board has had no trouble in abating nuisances.

No contagious diseases occurred during the year.

Don't know of any vaccinations during the year.

There are about two hundred unvaccinated children attending school.

The board has not met but three or four times during the year. Amount expended, \$48.00.

McCOMB, HANCOCK COUNTY.

Dr. J. A. Howell, health officer.

Population (estimated), 1,500.

Sanitary condition of streets and alleys is very good.

No complaint from lack of sewerage; but there is in one case of an outlet, which will be attended to in the spring. A slaughter house has given us some trouble, but with the exception of a few times has been kept in very good sanitary condition.

The night soil is handled by a scavenger in closed barrels and dumped a mile from the village, on ground provided by the village council.

Contagious diseases are properly reported but no record is kept at present.

Whooping cough has been most prevalent.

There are about fifty children attending school who are not vaccinated.

The village board of health met six times during the year.

No prosecutions brought by the board.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 3 cases; whooping cough, 20 cases.

McCONNELLSVILLE, MORGAN COUNTY.

William Dille, health officer.

Population (estimated), 2,000.

Our present sanitary condition is fairly good. Board has maintained an active organization and has been successful, because of vigilance, in enforcing proper measures for prevention of contagion and abatement of nuisances.

Streets, alleys and yards are fairly cleanly.

No cause of complaint from lack of sewerage or from improper discharge of same. We have no unabated nuisances.

Contagious diseases are properly reported but no proper record is kept.

Board has been able to enforce restrictive measures.

No contagion has been more prevalent than usual.

No record is kept of vaccinations. A number vaccinated but few successfully this year. Most of school children have been heretofore vaccinated.

Eleven meetings have been held. Amount expended, \$70.00.

No prosecutions were brought by the board.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 2 cases; typhoid fever, 1 case; whooping cough, 2 cases.

MCGUFFEY, HARDIN COUNTY.

Dr. J. B. K. Evans, health officer.

Population (estimated), 400.

The sanitary condition of our town is fairly good.

Night soil is buried.

Contagious diseases are reported promptly.

We have been able to enforce proper quarantine.

No vaccinations.

No prosecutions have been brought.

MADISONVILLE, HAMILTON COUNTY.

Dr. C. L. Metz, health officer.

Population (estimated), 4,000.

The board meets once a month, and oftener when necessary. On the call of the president, a full attendance of the members has been the rule.

The sanitary condition of the village is most excellent. The streets are scraped twice or three time a year and the accumulations carted away. The gutters are flushed whenever so ordered by the health officer. House to house inspection is made twice a year.

All vaults are cleaned when over two-thirds filled on the orders of the health or of the sanitary officer. Ten days is the time allowed to comply with an order to clean a vault, if not done the owner, agent or occupant of the premises is summoned before the Mayor and fined if necessary. We have not yet had occasion to impose a fine on any one.

Garbage is removed by the owner from his or her premises at their own expense. Night soil is carted away during the night time and placed on an open field and covered over with dry earth, or the vaults are filled up with dry earth and a new vault constructed.

Chicken-pox has been more prevalent than usual.

The rules of our board require physicians and parents to report immediately all contagious or suspected cases to the health officer, or clerk of board. Failure to comply with this rule is punished by a fine. The premises contain-

ing a contagious disease is at once placarded by the sanitary officer and the proper fumigation and disinfection made at the terminus of the case.

A record of all contagious diseases is kept by the clerk of the board.

Vaccination has been rigidly enforced at the public and parochial schools and the public generally. No pupil was permitted to attend school until compliance with the rule regarding vaccination. All pupils were reported vaccinated.

The amount spent by the board of health of our village was \$436.00.

Infectious diseases reported during the year: Diphtheria, 9 cases; typhoid fever, 12 cases; small-pox, 3 cases; whooping cough, 8 cases; measles, 10 cases; other infectious diseases, 56 cases.

MANSFIELD, RICHLAND COUNTY.

Dr. J. Harvey Craig, health officer.

Population (estimated), 20,000.

Streets, alleys and yards are in a cleanly condition. Our sewerage system is not adequate. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage are removed to a dumping ground one-half mile from the city.

Contagious diseases are properly reported and a record kept. Scarlet fever has been more prevalent than usual.

The board held twelve meetings during the year.

Infectious diseases reported during the year: Diphtheria, 40 cases; membranous croup, 2 cases; scarlet fever, 102 cases; typhoid fever, 15 cases; whooping cough, 20 cases; measles, 5 cases; other infectious diseases, 25 cases.

MARBLEHEAD, OTTAWA COUNTY.

A. J. Clemons, health officer.

Population (estimated), 1,800.

The village has been free from contagious or infectious diseases.

Our board held meetings every Sat-

urday during the small-pox scare at Lakeside. We have had no nuisances to complain of.

The board was at no expense this year. There were six meetings of the board held.

We have no sytem of sewerage only the natural drainage toward the lake.

MARIETTA, WASHINGTON COUNTY.

Dr. J. B. McClure, health officer.

Population (estimated), 16,000.

The present sanitary condition of our city is pretty good. The board has maintained an active organization and has probably met twenty times during the past year.

The streets and alleys are in the best condition they ever have been, which condition is due we believe to the board of health. Night soil and garbage are removed from the city to a place purchased by the city council, which piece of ground is entirely unfitted, on account of the character of the lay. We have had and do at present find difficulty in getting contagious diseases reported. A record is now being kept but am unable to find any record prior to Jan. 1, 1900.

The board spent something over \$1,200, however, that is only an estimate on my part.

MARSHALLVILLE, WAYNE COUNTY.

Dr. H. B. Wilford, health officer.

Population (estimated), 500.

No report.

Infectious diseases reported during the year: Diphtheria, 3 cases.

MARTINS FERRY, BELMONT COUNTY.

Dr. A. R. Ong, health officer.

Population (estimated), 8,000.

Streets, alleys and yards are in fair condition. Sewer system is being com-

pleted, after which there will be but little cause for complaint.

Garbage removed under contract. Night soil removed outside of city limits and buried.

Contagious diseases are promptly reported and a record is kept. Beginning with 1900, typhoid fever record will be kept. Board has been able to enforce its rules and orders.

Fourteen meetings of board were held during year. Have a good, active board of health. Board spent about \$400.00

No prosecutions were brought by the board.

Infectious diseases reported during the year: Diphtheria, 42 cases; membranous croup, 3 cases; scarlet fever, 2 cases, typhoid fever, no report made.

MASON, WARREN COUNTY.

Dr. C. T. Hall, health officer.

Population (estimated), 700.

Generally speaking, yards, alleys and streets are kept in a fairly good condition. Streets are scraped twice a year. Principal nuisance is pig pens. It is hard to get rid of them or keep them clean. Night soil is most always buried, and garbage is hauled away to a dump.

Contagious diseases are always looked after and houses are placarded, but diseases are not reported and no records are kept of them. Tonsillitis, measles, diphtheria and scarlet fever have been the most prevalent.

Board has held six meetings during past year, and spent nothing.

Infectious diseases reported during the year: Typhoid fever, 1 case.

MASSILLON, STARK COUNTY.

Dr. T. Clark Miller, health officer.

Population (estimated), 13,500.

Streets, alleys and yards are generally in good condition. A house to house inspection is made each year in April and May, then all premises must be

put in good condition, objectionable places are re-visited until they are made right. The larger part of the population are not within reach of the sewers. No complaint on account of sewage discharge. The board has been able to enforce its orders against nuisances. Night soil and garbage is taken to the farms surrounding the city and used, I suppose, as a fertilizer.

Contagious diseases are properly reported and a record is kept. The board has had little trouble in enforcing restrictive measures. None of these diseases have been unusually prevalent during the year.

Could not make any estimate of number vaccinated during the year—more however than usual. There are probably 10 to 15 per cent of the children in the public schools unvaccinated. In the parochial schools probably 50 per cent are not vaccinated. These are guesses in the absence of data.

The board of health has held two regular and three special meetings at which a quorum was present. The expenditures of the board have amounted to about \$1200 during the year.

There were no prosecutions for violations of laws and orders of the board.

MAUMEE, LUCAS COUNTY.

P. Hartman, health officer.

Population (estimated), 2,000.

There is a grave cause for complaint from lack of sewerage. Prominent citizens (owning vacant lots) object to be taxed for sewers. Town is in debt, and councilmen are weak in the back.

Contagious diseases (now) are reported and a record kept. Board has had no trouble to enforce restrictive measures.

Number of meetings held eleven. Expenditure, \$84.31.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 2 cases.

MECHANICSBURG, CHAMPAIGN COUNTY.

Dr. John C. Hathaway, health officer.
Population (estimated), 2,000.

The sanitary condition of town is excellent. All nuisances have been successfully abated. One man has a permit to remove night soil. The marshal keeps the key to the place of deposit.

Contagious diseases are reported and record kept. Scarlet fever and mumps have been most prevalent, however there has been only a few cases.

About 150 have been vaccinated, mostly children.

No money is paid direct by board of health. All bills are certified by health officer and paid by council.

The number of meetings depend upon existing circumstances. Records of proceedings are carefully kept.

Fifty children attending school unvaccinated.

Infectious diseases reported during the year: Scarlet fever, 8 cases; typhoid fever, 4 cases, other infectious diseases, mumps, 5 cases.

MEDINA, MEDINA COUNTY.

F. L. Harding, health officer.

Population (estimated), 2,300.

Our board is very active in attending to contagious diseases. Our town is in a healthy condition excepting we have a couple of cess pools to contend with in the heart of the city and as we haven't proper sewerage for them, they cause us a good deal of trouble. We have no trouble with closets or garbage.

Contagious diseases are reported very promptly. Measles were more prevalent than usual.

I think the board met seven times during the year, and the expense I think was \$65.00.

There were no prosecutions. I can't give a very accurate report as I was health officer only one-half of the year, but have tried to give it to you the very best I can and hope next year to do better.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 6 cases; typhoid fever, 5 cases; measles, 125 cases.

MELROSE, PAULDING COUNTY.

Thomas J. Meyers, health officer.

Population (estimated), 450.

Our village is one of the cleanest on the Nickel Plate Railroad. Alleys and streets are in good condition. Our board of health meets twelve times in a year. At present our village is free from any contagious diseases.

We have one hundred and fifty pupils in the public schools, nearly all of whom are vaccinated.

MENDON, MERCER COUNTY.

Dr. W. P. Clay, health officer.

Population (estimated), 800.

Our streets and alleys are filthy and wet. Drainage is very imperfect although we have an excellent outlet.

Contagious diseases are not properly reported. A record is kept, but the board has not been able to enforce either quarantine or disinfection in all cases. We have had an epidemic of scarlet fever, as report will show.

No vaccinating has been done. Very few of our school children have been vaccinated. About 200 are in attendance.

The board of health organized Nov. 3, 1899, and has held three meetings. Expenses of board, \$51.42. The board has not yet made allowance for services of health officer.

We have had no litigation.

Infectious diseases reported during November and December: Membranous croup (not reported), 1 case; scarlet fever, 50 cases; typhoid fever, 1 case; whooping cough, 3 cases.

MENTOR, LAKE COUNTY.

Dr. L. H. Luse, health officer.

Population (estimated), 1,200.

Streets, alleys and yards are in a cleanly condition. There is no cause of complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate.

There have been no contagious diseases to report. A record of such diseases is kept. Restrictive measures are enforced.

Total amount spent, \$10.00.

METAMORA, FULTON COUNTY.

B. M. Blain, health officer.

Population (estimated), 350.

No report.

Infectious diseases reported during the year: Membranous croup, 1 case.

MIDDLEBURG, LOGAN COUNTY.

Dr. G. E. Davis, health officer.

Population (estimated), 300.

Infectious diseases reported during the year: Scarlet fever, 12 cases; typhoid fever, 3 cases; whooping cough, 20 cases; measles, 15 cases.

MIDDLEPORT, MEIGS COUNTY.

Dr. D. Sisson, health officer.

Population (estimated), 3,000.

The board has maintained an effective organization and proper measures have been enforced for the prevention of contagious diseases and the abatement of nuisances.

The removal of night soil is left to the discretion of the health officer.

There is no cause of complaint from lack of sewerage. The town as a whole is in a fairly sanitary condition.

Contagious diseases are properly reported.

No vaccinations have been had that have come to the knowledge of the health officer.

There are from 300 to 400 children attending school that are unvaccinated.

The board has had but one meeting during the year and no expense has been incurred.

No prosecutions have been brought by the board for any purpose.

MIDDLETOWN, BUTLER COUNTY.

Dr. G. D. Lummis, health officer.

Population (estimated), 10,000.

Streets, alleys and yards are in a sanitary condition. There is no complaint in regard to sewerage. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage are removed by licensed wagons.

Contagious diseases are properly reported and a record kept. The board has been able to enforce restrictive measures. Whooping cough has been more prevalent than usual. There are about one hundred unvaccinated children attending the public schools.

The board met three or four times during the year. Amount spent, \$646.35.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 12 cases; typhoid fever, 3 cases.

MILFORD CENTER, UNION COUNTY.

Thos. Connor, health officer.

Population (estimated), 850.

Streets, alleys and yards are in fairly good condition. No complaint of sewerage or cause for complaint so far as known. There has been no nuisance which the board has tried to abate and failed, although there are some (in my opinion) that there has not been a proper effort made by the board to abate.

The arrangements for removal of night soil, etc., is to send notice to owner of premises to abate the same.

This order has been complied with except in one case, when the board (health officer) had the work done and charged on tax duplicate.

There have been but two cases of infectious disease in the corporation, one of these was properly reported and in the other case the doctor in charge got angry when asked about it. The board has made no efforts to enforce restrictive measures.

No one vaccinated during year. Probably 40 per cent. of children attending school never vaccinated.

The number of meetings held by the board will not average more than one a month (almost impossible to get a quorum together).

The total amount spent by board for the year is \$7.50.

There have been no prosecutions.

There is no record kept of contagious diseases so far as I know.

This report only covers eight months, that being the length of time I have been connected with the board.

Infectious diseases reported during the year: Typhoid fever, 2 cases.

MILLERSBURG, HOLMES COUNTY.

C. J. Fisher, health officer.

Population (estimated), 2,500.

No report.

Infectious diseases reported during the year: Diphtheria, 9 cases; typhoid fever, 1 case; small-pox, 7 cases.

MINERAL RIDGE, TRUMBULL COUNTY.

T. J. Jenkins, health officer.

Population (estimated), 1,000.

The sanitary condition of the town is excellent.

Infectious diseases reported during the year: Membranous croup, 1 case; typhoid fever, 10 cases.

MONTPELIER, WILLIAMS COUNTY.

Dr. H. W. Wertz, health officer.

Population (estimated), 2,200.

Our sanitary condition is good. Our board of health keeps up its organization and looks after contagious diseases, etc., very well, which my report will show.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 3 cases; whooping cough, 11 cases; measles, 3 cases.

MT. CORY, HANCOCK COUNTY.

Jacob Doty, health officer.

Population (estimated), 300.

Streets, alleys and yards are kept in safe sanitary condition. No difficulty experienced in enforcing rules of board. Night soil is cared for by individuals as directed by the board, viz., removed from town limits or buried.

Two cases of whooping cough properly reported. This is the only disease of infectious character in the town during the year.

Two persons vaccinated. Ninety-eight children attending school not vaccinated.

Number of meetings held during the year, three. Amount spent by board during the year, \$5.00.

MT. GILEAD, MORROW COUNTY.

Dr. F. C. Griffis, health officer.

Population (estimated), 2,000.

The property owners are notified through the press and by printed notices, the first week in April to put their yards and alleys that adjoin in shape so that they will be free from ash-piles, manure-piles and such debris as will collect during the winter, also to put their water closets in proper shape and in good sanitary condition. These things must be done by the 15th of April or the same will be done by the health officer

by direction of board of health and the expense incurred will be added to the tax duplicate of said property owner.

The board, by the advice of health officer, issued an order that all cesspools must be properly drained, and all weeds cut on vacant lots and burned, or steps would be taken to have the same done at property owner's expense. In some instances this was done. Total expense, \$840.00.

The board has provided a dumping ground where all garbage is disposed of.

All contagious diseases are at once reported and a record is kept.

The laws of quarantine are strictly followed.

The board meets the first Thursday night of each month and at such other times as the health officer may indicate.

Infectious diseases reported during the year: Membranous croup, 1 case; typhoid fever, 3 cases; whooping cough, 5 cases.

MT. PLEASANT, JEFFERSON COUNTY.

T. P. Gorsuch, health officer.

Population (estimated), 800.

We have been very successful in controlling contagious diseases.

Our streets and alleys are as cleanly as it is possible to have them at this season of the year. We have them cleaned in the spring and fall.

All contagious diseases have been reported promptly and we have had no trouble in enforcing restrictive measures, the citizens co-operating with us. We have only had the diphtheria to contend with and confined it to two families.

There has been no one vaccinated during the year.

The board has only held one meeting during the year, at which meeting they empowered the health officer and clerk to attend to any cases which might arise, with power to call a meeting of the board for consultation if necessary.

Our expenses have been, for a formaldehyde generator, \$31.10; for wood

alcohol, \$21.10; for salary of clerk and health officer, \$30.00. Total, \$82.20.

Infectious diseases reported during the year: Diphtheria, 4 cases.

MT. STERLING, MADISON COUNTY.

Dr. R. H. Trimble, health officer.

Population (estimated), 1,500.

Streets and alleys are in fair condition. Our town has not sufficient sewerage. Night soil is taken to a dump about one and a half miles from town. A great deal of it is taken to the country by farmers, together with stable manure.

Contagious diseases are properly reported and we succeed pretty well in enforcing proper restrictions.

Measles have been more prevalent here than any other contagious disease. There have been about fifty or sixty vaccinated. Number attending school yet unvaccinated is 129.

Board has held six meetings during year and spent \$29.50.

Infectious diseases reported during the year: Measles, 10 cases.

MT. VERNON, KNOX COUNTY.

Dr. Harry W. Blair, health officer.

Population (estimated), 8,000.

The streets and alleys are kept clean, in much better condition than in former years, as the people are becoming educated. No cause for complaint from lack of sewerage.

We have little difficulty abating any nuisances. A part of the garbage and night soil is buried or burned at the city garbage grounds. A part is hauled to the country by farmers.

We have some difficulty in having contagious diseases reported. This is especially so where no physician is called. We enforce restrictive measures as fully as possible. A record of all contagious diseases is kept.

About 300 children were vaccinated during the year. Probably one-third of

the children attending school in the city are not vaccinated.

The board has held about eight meetings during the year. Expenses, including salaries of officers, \$700.00. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 19 cases; typhoid fever, 8 cases; other infectious diseases, 12 cases.

MURRAY CITY, HOCKING COUNTY.

Dr. T. J. Dillinger, health officer.

Population (estimated), 1,100.

The sanitary condition of Murray City at present is only fair.

We have been unable to maintain an active organized board of health during the past year. I have been compelled to act as health officer and board of health also. I have been successful in enforcing all health measures, preventing infectious diseases and abating all nuisances.

Streets, alleys and yards are not in a very good condition at present. We have no pavements, sidewalks or piked streets and our town is very muddy this time of year. I expect to have a board organized after our spring election, then we will clean up the town. We have but little cause for complaint from lack of sewerage. We have had no nuisances that I have failed to abate. I have had to threaten prosecution a few times, but when I became determined the nuisance went.

Night soil and garbage is hauled away, buried or disposed of by the street commission by my order.

I have reported all contagious diseases within the past year. I keep as good report of such diseases as I can. I have very poor facilities for such record. I am poorly furnished with means or supplies. I have been able to enforce all necessary measures to preserve health and life.

We have had no prevalent contagious disease.

We have had no persons vaccinated within the past year. I judge we have 200 pupils, who have never been vaccinated, attending our public schools.

We have had two meetings of the board of health in our village within the past year. Part of the members moved away and others resigned. The board of health spent direct within the past year about \$20.00.

I have not had to prosecute any person for neglect of abating nuisances or other violations.

Infectious diseases reported during the year: Scarlet fever, 6 cases; typhoid fever, 1 case; whooping cough, 3 cases; measles, 1 case.

NAPOLEON, HENRY COUNTY.

O. E. Barnes, health officer.

Population (estimated), 4,500.

The board has maintained an active organization, and has been successful in enforcing proper measures for prevention of contagious diseases, except vaccination, which they claim they cannot enforce until the disease is among us.

There was complaint last year of improper discharge of sewage, which council has of late remedied.

No nuisance which the board has unsuccessfully tried to abate.

Contagious or infectious diseases are reported properly, I think, with the exception of whooping cough.

No complete record of contagious diseases is kept.

All night soil removed two miles from corporation by one man with approved air-tight barrels. Removal regulated by ordinance, and done under supervision of health officer.

Garbage is disposed of on a dump ground outside of the corporation, and near no residence.

The superintendent of schools informs me that there are at least 550 unvaccinated children attending public schools in the village of Napoleon, out of 750 — but very few, if any, have been vac-

inated during the past year. I have been urging vaccination, but the people will not hear to it.

The present sanitary condition of the village is very good.

The board of health has spent for the past year about the same as last year, \$275.00.

No prosecutions for violations of health laws.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 1 case; typhoid fever, 4 cases; chicken-pox, 2 cases; whooping cough, 3 cases; measles, 7 cases.

NASHVILLE, HOLMES COUNTY.

David Parks, health officer.

Population (estimated), 400.

Streets, alleys and yards are in fair condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate. No arrangements for the disposal of night soil or garbage.

There have been no contagious diseases to report.

Several meetings were held by the board. Total amount spent, \$2.00.

NAVARRE, STARK COUNTY.

John Bailis, health officer.

Population (estimated), 1,000.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate.

Contagious diseases are properly reported and a record kept. Proper restrictive measures have been enforced.

Monthly meetings are held by the board. Total amount spent, \$45.00.

Infectious diseases reported during the year: Diphtheria, 3 cases; typhoid fever, 2 cases.

NEVADA, WYANDOT COUNTY.

Dr. S. S. Barrett, health officer.

Population (estimated), 1,500.

Streets, alleys and closets are kept clean by street commissioners and health officer.

Contagious diseases are promptly reported and quarantined. No vaccination here for several years.

Several nuisances were abated. No prosecutions were brought by the board. Total expense for the year, \$27.00.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 3 cases; typhoid fever, 7 cases.

NEW ALBANY, FRANKLIN COUNTY.

Geo. D. Ulry, health officer.

Population (estimated), 300.

The doctors are very slow in making reports. The sanitary condition of our town is very good. Our board is not regular in its meetings.

There are no arrangements for the removal of night soil. This is the worst nuisance we have.

Infectious diseases reported during the year: Scarlet fever, 2 cases; measles, 8 cases.

NEW ALEXANDRIA, JEFFERSON COUNTY.

Nathan McGrew, president board of health.

Population (estimated), 200.

Situated along a ridge road. Drainage towards the north and south and is good natural drainage both ways. Streets and alleys in good condition. Alleys usually in natural blue grass. No complaints in regard to sewerage. No nuisances but which are promptly removed, except stable manure during winter months. No arrangements for disposal of night soil and garbage. We have no report of diseases or records of the same. Whooping cough last spring was most prevalent. The children, except extra young, are mostly vaccinated.

Infectious diseases reported during the year: Whooping cough, 24 cases; measles, 1 case.

NEWARK, LICKING COUNTY.

Dr. D. M. Smith, health officer.

Population (estimated), 22,000.

Sanitary condition of our streets and alleys is good. Night soil has been buried in ground provided for that purpose.

Contagious diseases have been properly reported. I am unable to ascertain the number of meetings, as records have been lost.

The Metz slaughter house should be moved as it is a nuisance (in my opinion the worst in the city), but we have had trouble getting a quorum present at our meetings, therefore have been unable to do some business which should be very carefully considered.

There are probably about 200 children (going to school) who have not been vaccinated.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 1 case; scarlet fever, 35 cases; measles, 1 case.

NEW BREMEN, AUGLAIZE COUNTY.

Dr. M. S. Ekermeier, health officer.

Population (estimated), 1,800.

Streets, alleys and yards are in fair condition. We have a good sewerage system for a town of this size. The board has been successful in the abatement of nuisances. Night soil is carted out of town.

Contagious diseases are reported when we have any, but no record is kept. Restrictive measures have been enforced. About fifty per cent of the school children are unvaccinated.

The board of health held four meetings during the year. Total expenditure, \$16.60. No prosecutions.

NEWBURG, CUYAHOGA COUNTY.

Dr. E. G. Radway, health officer.
Population (estimated), 5,000.

Streets, alleys and yards are in fair condition. Our sewerage system is inadequate. Night soil and garbage are disposed of by arrangement with the city of Cleveland.

Contagious diseases are not properly reported, but a record is kept of such as are. Small-pox and diphtheria have been more prevalent than usual.

The board has held twelve meetings during the year and expended about \$100.00.

Infectious diseases reported during the year: Diphtheria, 7 cases; scarlet fever, 2 cases; small-pox, 1 case.

NEW CARLISLE, CLARK COUNTY.

George W. Pierce, health officer.
Population (estimated), 1,000.

The present sanitary condition of the village is good. Our board has an active organization and have been very successful in enforcing all sanitary measures, in fact the citizens generally take great interest in preserving the health of the village, consequently, there is no trouble in enforcing all rules and regulations of the board of health.

All contagious diseases are properly reported and record kept.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 3 cases; small-pox, 6 cases; measles, 1 case.

NEW HOLLAND, PICKAWAY COUNTY.

Samuel McGath, health officer.
Population (estimated), 1,200.

From the following report it is shown that our village is in a good healthy condition. Our board doesn't have meetings as often as I would recommend. They depend on the health of-

ficer too much, but our streets and alleys are in as good condition as could be expected this time of the season.

All contagious diseases are duly reported and every precaution taken to prevent contagious diseases. No prosecutions brought by the board of health.

Infectious diseases reported during the year: Typhoid fever, 6 cases.

NEW LONDON, HURON COUNTY.

Dr. A. M. Turner, health officer.
Population (estimated), 1,800.

Sanitary condition of our village is good. Our streets, alleys and yards are clean. Our sewerage is poor.

We have abated all nuisances. Night soil and garbage are removed from corporation.

All contagious diseases are reported. There is a record kept of all contagious diseases.

The local board did not require children of our public schools to be vaccinated. Total expenditures, \$125.00.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 3 cases.

NEW PHILADELPHIA, TUSCARAWAS COUNTY.

Dr. Geo. H. Peck, health officer.
Population (estimated), 7,000.

Streets and alleys are in a cleanly condition. Sewerage only in small portion of the city. A person authorized by the board of health removes night soil and garbage.

Contagious diseases are properly reported and record of such diseases kept. The board has been able to enforce proper restrictive measures. Whooping cough has been more prevalent than usual. Do not know the number of persons vaccinated during the year. The number of children unvaccinated, attending public school, 1,000.

The number of meetings held by the board of health during the year, twelve.

The number of prosecutions for violating the sanitary ordinance respecting privies, five; results good. The amount spent by the board of health during the year, \$220.70.

Infectious diseases reported during the year: Diphtheria, 20 cases; membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 9 cases; whooping cough, 1 case; measles, 11 cases.

NEW RICHMOND, CLERMONT COUNTY.

Dr. J. A. Windsor, health officer.

Population (estimated), 3,500.

Streets, alleys and yards are in good sanitary condition. Sewerage all right. Hog pens have caused us considerable trouble and expense. Night soil and garbage properly taken care of.

Contagious diseases are properly reported and a proper record kept. Board has been able to enforce proper restrictive measures. We have been blessed as we have had but very little of contagious diseases in 1899.

About 100 have been vaccinated during the year. About 75 unvaccinated children attending public schools.

Board meets regular, the first Thursday night in each month. Have spent during 1899 about \$100. Have had no prosecutions.

Infectious diseases reported during the year: Diphtheria 1 case; membranous croup, 1 case; scarlet fever, 2 cases; typhoid fever, 5 cases.

NEW RIEGEL, SENECA COUNTY.

Anthony Imber, health officer.

Population (estimated), 320.

No report.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 1 case; measles, 2 cases.

All these five cases were of a very mild form, no deaths, no school being suspended on account of any kind of sickness.

NEW STRAITSVILLE, PERRY COUNTY.

Thomas Taylor, health officer.

Population (estimated), 3,000.

The health board has maintained an active organization and has been very successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances.

Streets, alleys and yards are not in the best of condition at present, and perhaps there is room for complaint. There is no complaint in regard to sewage, and there are no nuisances which the board has not been able to remove. There are no arrangements made for the removal of night soil and garbage.

I think all contagious diseases have been promptly reported to the health board, but only a partial record is kept. The board has been able to enforce proper restrictive measures.

Typhoid fever has been more prevalent than any other disease. Unvaccinated children attending school, 481.

Number of meetings held by board during the year, about six. Amount spent by board of health, nothing — only the salary of health officer, and that is five dollars per month, and sometimes a little cost in burying dead hogs or dogs found dead with no owners.

No money spent in prosecutions of any kind by the board.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 21 cases.

NEW VIENNA, CLINTON COUNTY.

Dr. Geo. R. Conard, health officer.

Population (estimated), 800.

The sanitary condition of the village during the past year has been excellent with no prevailing or epidemic disease.

The board of health has held very few meetings, made a tour of inspection in the spring, ordered the village cleaned, arranged for the work and held themselves ready for call meetings.

The streets and alleys are generally kept in comparatively good condition.

NEW WASHINGTON, CRAWFORD
COUNTY.

Geo. B. Wolf, health officer.

Population (estimated), 1,000.

Streets, alleys and yards are in a fairly cleanly condition. There are no nuisances which the board has unsuccessfully tried to abate.

Contagious diseases are properly reported and a record kept.

The board of health has held no meetings during the year and no money has been expended.

Infectious diseases reported during the year: Scarlet fever, 10 cases.

NEY, DEFIANCE COUNTY.

Dr. P. M. Lehman, health officer.

Population (estimated), 2,000.

No report.

Infectious diseases reported during the year: Whooping cough, 20 cases; measles, 12 cases.

NORTH AMHERST, LORAIN
COUNTY.

Dr. N. H. Cornwell, health officer.

Population (estimated), 1,800.

The sanitary condition of town is very good.

We need sewers on some of the principal streets.

Contagious diseases are reported in most cases.

Scarlet fever has been more prevalent than usual.

Cannot ascertain number of children vaccinated as schools are closed at present time.

Board of health has had three meetings during last year. Total amount spent last year will not exceed \$60.00.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 8 cases; typhoid fever, 1 case.

NORTH HAMPTON, CLARK
COUNTY.

Dr. E. B. Davis, health officer.

Population (estimated), 200.

Our village is in a cleanly condition and there is no need for complaint as to nuisances or the disposal of garbage.

Contagious diseases are properly reported and quarantine thoroughly instituted. We have not kept a record of the contagious diseases. We have had but very few during the past year. Small-pox has not been in our community, so that few persons have been vaccinated. There has not been compulsory vaccination in our schools.

The board does not hold any regular meetings nor has it been necessary to call a meeting at any time. All cases are reported to me and proper and prompt investigation made.

The total expense of the board for the past year has been \$13.00.

NORTH BALTIMORE, WOOD
COUNTY.

J. W. Stoner, health officer.

Population (estimated) 3,200.

Sanitary condition good. Night soil and garbage are buried about half a mile out of town.

Contagious diseases are not properly reported, but there is some improvement. With one or two exceptions all the doctors now report diphtheria and scarlet fever. It was difficult to enforce restrictive measures in scarlet fever cases, as the general type of the epidemic was so mild that it caused little fear, and because some of the doctors persisted in calling it "scarlet rash."

Number of persons vaccinated, none.

Held thirteen meetings during the year and expended \$225.68.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever (partly estimated), 60 cases; measles, 8 cases.

NORTH LEWISBURG, CHAM- PAIGN COUNTY.

A Spain, health officer.

Population (estimated), 1,050.

Streets, alleys and yards for the most part are in a cleanly condition.

We have no sewerage and there is no complaint from the lack of same.

There are no nuisances which the board has tried to abate and failed.

Each family is required to dispose of their own night soil and garbage.

Contagious diseases are properly reported with a few exceptions.

The board has been able to enforce proper restrictive measures.

Membranous croup has been more prevalent than usual. The one case is the first case we have had for a great while.

Estimated number of persons vaccinated during year, 5. Unvaccinated children attending school, 120.

The board has held three meetings during the year.

The board has spent fifteen dollars for the year.

The board has brought no prosecutions for violations of its orders or of health laws.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 2 cases.

NORTH ROBINSON, CRAWFORD COUNTY.

J. J. Robertson, health officer.

Population (estimated), 260.

The sanitary condition of the village is good. Sewerage is good. We have no complaint to offer. Had no contagious diseases since organization. We hold monthly meetings.

One-half the pupils attending school not vaccinated.

NORWALK, HURON COUNTY.

Dr. Edgar Martin, health officer.

Population (estimated), 7,500.

Streets are in a satisfactory sanitary condition.

Night soil disposed of outside of city, between 11 P. M. and 4 A. M.

Contagious diseases properly reported and record kept of same.

Measles, in mild form, prevalent during the past year.

Board of health meets regularly twice a month.

Two prosecutions by health board to enforce rules as to inspection of cows of milk men.

Infectious diseases reported during the year: Diphtheria, 4 cases; typhoid fever, 5 cases; measles, 15 cases.

NORWOOD, HAMILTON COUNTY.

Dr. J. C. Cadwallader, health officer.

Population (estimated), 8,000.

The sanitary condition is excellent.

Streets and yards are kept in a cleanly condition. The sewerage system is being as speedily completed as possible. Only a small district is now incomplete. Bids are being advertised for the construction of sewers at present.

Garbage is collected twice a week during the summer months and once a week during the winter and disposed of without causing a nuisance. Night soil is buried outside of corporate limits.

Contagious diseases are properly reported and records of same are accurately kept. All restrictive measures in regard to same have been enforced. Varicella has been the most prevalent contagious disease. All children were compelled to have certificates of vaccination.

The board holds regular meetings once per month.

Board has expended \$1,860 during the year.

We have been exceptionally free from epidemics, as the mortality indicates.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 18 cases; typhoid fever, 7 cases; whooping cough, 26 cases; measles, 15 cases; other infectious diseases, 20 cases.

OAK HARBOR, OTTAWA
COUNTY.

Dr. F. S. Heller, health officer.

Population (estimated), 1,800.

Our town is in a very good sanitary condition and has been so during the last year.

We have been able to abate all nuisances which have developed. Night soil is hauled out of limits and buried.

All contagious diseases are reported and record kept.

We have not had prevailing any contagious disease in excess of previous years.

Scarlet fever of a mild form has been the only disease.

The health board has held about seven meetings during the last year. Have not found it necessary to prosecute any cases for violation of laws.

Infectious diseases reported during the year: Scarlet fever, 10 cases.

OAKLEY, HAMILTON COUNTY.

E. C. Wamacks, health officer.

Population (estimated), 500.

This being a suburban village we have no sewers as yet. All nuisances have been properly abated. Contagious diseases have been properly reported and a record kept. Streets, alleys and yards are in a sanitary condition. There are sixty-eight unvaccinated pupils attending the public schools.

The board has held six meetings and spent \$21.00.

OBERLIN, LORAIN COUNTY.

W. L. Biggs, health officer.

Population (estimated), 4,700.

No report.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 3 cases; typhoid fever, 9 cases; measles, 80 cases.

OHIO CITY, VAN WERT
COUNTY.

E. B. Grunden, health officer.

Population (estimated), 1,000.

Sanitary condition good, except sewerage.

Health board meets twice each month; sometimes there is no quorum, so no business is done.

Do not have to prosecute to enforce any of the laws.

Night soil and garbage are buried to the depth of two and one-half feet.

All contagious diseases are properly reported and quarantined immediately on report of physician.

I think about one-third of the children attending school are unvaccinated.

Infectious diseases reported during the year: Whooping cough, 2 cases.

ORRVILLE, WAYNE COUNTY.

Dr. A. A. Brooks, health officer.

Population (estimated), 2,000.

Our board had eight meetings last year, has been successful in abating all nuisances, and is an active organization. Has been successful in enforcing proper measures for prevention of contagious diseases.

Streets and alleys are kept as clean as they can be without sewerage. No arrangement has been made for disposal of garbage and night soil. Have requested council time and again to make some provision for disposal of same.

Contagious diseases are reported properly and a record kept. The board has enforced proper restrictive measures. Scarlet fever and diphtheria have been most prevalent. No record has been kept of people vaccinated. There are a few children going to school who have not been vaccinated.

No prosecutions brought by board.

There are one hundred and twenty-eight unvaccinated children attending school.

Infectious diseases reported during the year: Diphtheria, 18 cases; scarlet fever, 42 cases; typhoid fever, 1 case; measles, 2 cases.

OSGOOD, DARKE COUNTY.

A. R. Lupinger, health officer.

Population (estimated), 300.

We did not organize until Aug. 8th, 1899, and have only held five meetings since. Have had no violation of laws or orders. Our streets are not in the best sanitary condition, but think it will be better soon.

Have had three cases of scarlatina, simple, but with prompt action of the board it never spread from the house it started in. There has been no vaccination of any one that we know of.

Total amount spent, \$5.00.

Infectious diseases reported during the year: Scarlet fever, 3 cases; whooping cough, 3 cases.

OTTAWA, PUTNAM COUNTY.

Dr. E. L. Tupper, health officer.

Population (estimated), 3,000.

The streets, alleys and yards are in a cleanly condition. The sewerage here is as good as we can expect from the limited water supply and the arrangement of village. However, we hear no complaint therefrom. The board has been successful so far in keeping the town in good sanitary condition. A regular man is employed to perform the night work. He is equipped with tightly closed barrels, and does the work well. The night soil and garbage are buried.

Contagious diseases are promptly reported and due precautions always taken. Complaints are few and quarantine is enforced without much trouble. A record is kept, and reports of same sent to State Board.

Scarlatina has been most prevalent here, although not many cases.

Board of health here held meetings

every three months. No prosecutions.

225 vaccinated children attend the public schools. \$100.00 spent last year.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 1 case; scarlet fever, 15 cases; typhoid fever, 16 cases; whooping cough, 6 cases; measles, 3 cases; other infectious diseases, 4 cases.

OTWAY, SCIOTO COUNTY.

Alf Jones, health officer.

Population (estimated), 300.

Sanitary condition of village is fair. No cause at present for complaint from lack of sewerage or from improper discharge of same. No nuisances which the board has unsuccessfully tried to abate. No arrangements made as yet for removal of night soil and garbage.

Contagious diseases are properly reported, and record kept of same. The board has not made much of an effort to enforce anything whatever. Diphtheria has been more prevalent than usual.

Could not ascertain the number of unvaccinated children attending school. Board of health held one meeting during the year. Board spent \$12.00.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 3 cases; measles, 1 case.

OXFORD, BUTLER COUNTY.

Dr. W. E. Calohan, health officer.

Population (estimated), 1922.

The streets and alleys are in good condition. There is no sewerage here. There is no nuisance that the board has unsuccessfully tried to abate. They have a garbage wagon that makes the round of the town twice a week and hauls off the garbage. They remove night soil after 10 P.M., in tight barrels.

There has been no contagious diseases to report in the last year. The board has been able to enforce proper restrictive measures. The superintendent of schools says it is impossible to

find out the number of unvaccinated children attending school, but has made an effort to have them vaccinated every year.

The board has held eight meetings in the last year.. They have spent \$105 last year.

PAINESVILLE, LAKE COUNTY.

Dr. E. D. Whitney, health officer.

Population (estimated), 6,000.

Our streets are in good condition. Private yards are to be improved next spring. Sewer system is giving good satisfaction. The contents of privy vaults is carted in closed barrels out of city limits where it is plowed under immediately. Street scrapings is used as fertilizer on yards or to fill low places, depending on its nature.

Table refuse is an unsolved problem. some new plan will be tried next spring.

Ashes and rubbish go to the dumping ground outside limits furnished by board of health.

No record of contagious diseases was kept by former health officer, but has been, by the present one. Most of the doctors are willing aids in this work.

About 300 vaccinations during the year. The superintendent of schools estimates that 70 per cent of the 1,000 pupils are vaccinated.

The board has held eight meetings, and spent \$605.38 during the year. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 5 cases; small-pox, 1 case; whooping cough, 2 cases.

PATASKALA, LICKING COUNTY.

Frank McConaughy, health officer.

Population (estimated), 700.

The present sanitary condition of our village is good. Our board has maintained an active organization and has been successful in enforcing proper

measures for the prevention of contagious diseases and the abatement of nuisances.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from the lack of sewerage or from an improper discharge of sewage. There are no nuisances which the board unsuccessfully tried to abate.

Contagious diseases are properly reported and a record of such diseases is kept. The board has been able to enforce proper restrictive measures.

Eight meetings of the board of health were held during the year. Total amount spent by the board of health during the year is \$19.12.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 2 cases.

PATTERSON, HARDIN COUNTY.

P. C. Breidenbach, health officer.

Population (estimated), 300.

The sanitary condition of the village is fairly good. No contagious diseases prevailing except two cases of supposed scarlet fever, very mild ones.

A full board of health has been organized since Dec. 30, 1899 and hold monthly meetings.

There are 64 scholars in school of which only five are vaccinated.

Infectious diseases reported during the year: Scarlet fever, 2 cases.

PAULDING, PAULDING COUNTY.

Dr. John U. Fauster, health officer.

Population (estimated), 3,000.

Streets and alleys are in excellent condition. Sewerage good. Board has been successful in abating nuisances. All night soil and garbage taken to the "dump ground" about one mile from village and buried.

Contagious diseases are properly reported. Proper restrictive measures carried out. Typhoid fever has been more prevalent than usual.

Don't know how many persons were vaccinated last year and have no means of finding out. Fully 50 per cent of the children at school not vaccinated.

Board of health meets once a month. About \$200 spent during the year. No prosecutions brought.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 5 cases.

PAYNE, PAULDING COUNTY.

Dr. J. E. Mulligan, health officer.

Population (estimated), 1,700.

The board of health does not have regular meetings. I do not know how many were held during the year. The sanitary condition of the village is bad on account of improper sewerage.

Infectious diseases reported during the year: Typhoid fever, 3 cases; measles, 40 cases.

PIONEER, WILLIAMS COUNTY.

William B. Ferris, health officer.

Population (estimated), 596.

The sanitary condition of village is good.

No cause for complaint on account of sewerage.

No nuisances which the board can not abate.

All contagious diseases are properly reported and a record is kept. The board has been able to enforce restrictive measures.

Seven meetings were held during the year.

Ten dollars spent during year.

No one prosecuted during year by board of health.

PIQUA, MIAMI COUNTY.

Dr. F. E. Kitzmiller, health officer.

Population (estimated), 14,000.

Sewers are all in good condition. Garbage removed by farmers and night soil hauled out and buried in trenches.

Contagious diseases are promptly reported and precautions carried out to the letter.

Very few vaccinated, as small-pox has not been very near.

Board meets regularly every month. Two prosecutions during the year for violation of quarantine. Both fined by mayor.

Total amount spent by board during year, \$700.00.

Infectious diseases reported during the year: Diphtheria, 16 cases; scarlet fever, 7 cases; typhoid fever, 90 cases; whooping cough, 50 cases; measles, 25 cases.

PLAIN CITY, MADISON COUNTY.

Dr. J. S. Howland, health officer.

Population (estimated), 2,000.

Our streets and alleys are in fair condition. We lack in sewerage, but all nuisances are promptly abated.

We have a dumping ground, outside of the city limits, under the charge of one scavenger, who is appointed by the board of health and who buries all night soil and keeps the grounds cleaned.

Contagious diseases are not reported as they should be, but when a report is received a record is made, and the diseased patient properly restrained.

Small-pox is the most prevalent contagious disease, but a mild form of whooping cough prevailed in April, May and June. About 200 unvaccinated children attended the schools in January and February last, but owing to a case of small-pox last March many were vaccinated which left it better protected.

Board met eight times during the year. I can only approximate the expenses at \$400 — having no account of my own.

No prosecutions except in one case where night soil was buried on the premises. This was dug up by my order and the amount for services certified to county auditor.

During the recent epidemic of small-pox we have enforced a rigid quarantine under the supervision of sanitary

policemen, and by stopping the schools and all public gatherings we have succeeded beyond my expectations. While the physicians were tardy in the beginning they acted with promptness when they were convinced as to the prevailing disease.

Infectious diseases reported during the year: Small-pox, 21 cases.

PLEASANT CITY, GUERNSEY COUNTY.

J. F. Secrest, health officer.

Population (estimated), 1,200.

Streets, alleys and yards are in a cleanly condition.

We have no sewerage, though some is needed.

There is no nuisance that the board has tried to abate and failed; but there exists a slaughter house just outside the corporation about which much complaint is made, and not without cause. A stream comes from it right inside the corporation and in warm weather there is a very bad smell in the east end of the village.

I believe that contagious diseases have not been reported, but there have been none except such as whooping cough and fever. No record is kept.

Nothing has been spent by the board of health during the year except for services of health officer.

None of the contagious diseases have been more prevalent than usual, except whooping cough.

Board of health has only held two meetings during the year at which business was transacted.

No prosecutions have been brought by board.

Garbage and night soil has to be removed out of corporation by owners of property or properly dried or absorbed by some good absorbent and then buried.

Two hundred and three school children are unvaccinated.

PLEASANT HILL, MIAMI COUNTY.

Dr. A. J. Bausman, health officer.

Population (estimated), 700.

The sanitary condition of our town is good.

Contagious diseases are reported and a record kept. The board has been able to enforce proper restrictive measures. Small-pox has been more prevalent than usual.

Five meetings of the board were held during the year. Total amount spent, \$38.75.

Infectious diseases reported during the year: Small-pox, 2 cases.

PLEASANT RIDGE, HAMILTON COUNTY.

C. W. Acomb, health officer.

Population (estimated), 1,250.

We have maintained an active organization and have been successful in enforcing proper measures to abate any and all nuisances and also for the prevention of contagion.

Streets, alleys and yards are in fairly good condition. We have no system of sewerage and have no particular need of same.

Garbage is burned as much as possible.

Night soil is removed outside of village on isolated farming lands and worked into the ground with other fertilizers.

Contagious diseases are properly reported and a record kept, and restrictive measures are enforced. Measles in a very mild form was prevalent during the spring months.

We believe almost all children in the village and some adults have been vaccinated. An effort by the board to that end was generally approved by parents.

Board meets regularly monthly. Have had quorum about six meetings. Expenditures for the year, \$125.00.

Infectious diseases reported during the year: Diphtheria, 1 case; measles, 33 cases.

PLEASANTVILLE, FAIRFIELD
COUNTY.

Dr. W. E. Baker, health officer.

Population (estimated), 750.

Our streets and alleys are in fair condition. No complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate. No arrangements are made for the disposal of night soil or garbage.

Contagious diseases are properly reported and a record is kept. Restrictive measures have been enforced. Scarlet fever and measles have been more prevalent than usual. Nearly all school children are unvaccinated.

The board held two meetings during the year and spent \$15.00.

Infectious diseases reported during the year: Scarlet fever, 5 cases.

POLK, ASHLAND COUNTY.

Dr. W. H. Reinhart, health officer.

Population (estimated), 250.

Our village being not very thickly populated and laying on a rolling or naturally well drained surface, the question of drainage does not bother us much. It is as clean as the average village.

An ordinance requires the removal of night soil from privies and buried in the months of March and November.

Contagious diseases are reported to the board. I don't know if records are kept or not. The board is able if it will to enforce measures. Have had no prevalent disease — scarlatina prevalent around us.

No vaccinations during the year. Ten children in school have been vaccinated. Forty-four have not been.

Board has had no meetings in the year and did no business.

Infectious diseases reported during the year: Scarlet fever, 1 case.

PORTAGE, WOOD COUNTY.

Joseph Close, health officer.

Population (estimated), 800.

The health of the village is good and has been during the past year, with the exception of December. Scarlet fever has been more prevalent than usual.

Our system of sewerage is good and works satisfactorily. The streets and alleys need cleaning, but this is always the case at the end of winter. We have a contract for removing night soil to our dump ground beyond the corporation limits.

The number of meetings held by the board was six.

Infectious diseases reported during the year: Scarlet fever, 12 cases; whooping cough, 2 cases; other infectious diseases, 15 cases.

PORT CLINTON, OTTAWA
COUNTY.

Dr. Paul de la Barre, health officer.

Population (estimated), 3,200.

Streets, alleys and yards are in cleanly condition. Improvement in sewerage has been made during the year. Hogpens could not be removed with success. The town has provided a dumping ground for disposal of night soil and garbage.

Contagious diseases are properly reported and a record kept. Restrictive measures have been enforced. Scarlet fever and diphtheria were prevalent during the year.

Number of unvaccinated children attending school, 276.

Board of health had about 18 meetings during the year. Total amount spent by board of health for the year, \$250. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 24 cases; membranous croup, 1 case; scarlet fever, 18 cases; typhoid fever, 4 cases; measles, 1 case.

PORTSMOUTH, SCIOTO COUNTY.

Dr. Joseph Swander, health officer.

Population (estimated), 20,000.

Streets, alleys and yards are in a moderately cleanly condition. Our sewerage system is fairly good. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage are deposited in trenches and covered over.

Contagious diseases are properly reported and a record kept. We have been able to enforce proper restrictive measures.

The board has held nine meetings during the year. Total amount spent, \$1,269.60.

Infectious diseases reported during the year: Diphtheria, 27 cases; membranous croup, 3 cases; scarlet fever, 14 cases.

PROCTORVILLE, LAWRENCE COUNTY.

Dr. W. W. Reynolds, health officer.

Population (estimated), 550.

The streets and alleys are in good condition.

No record of contagious diseases is kept.

The board has been able to enforce proper restrictive measures. Nearly all our children of school age have been vaccinated.

The board of health has held about six or eight meetings during the year, and expended \$325.50.

No prosecutions.

Probably 300 or more persons vaccinated during the year.

Infectious diseases reported during the year: Small-pox, 34 cases.

PUT-IN-BAY, OTTAWA COUNTY.

Adam Heidle, health officer.

Population (estimated), 275.

Our board of health was organized the 13th of last June and has maintained an active organization since. The board has had four meetings since organiza-

tion. No contagious disease has been within the village during the year.

Nuisances were of minor importance and easily abated. Night soil and garbage are either burned or buried. We have no system of sewerage. A few persons have their own sewers. Complaints made against lack of proper sewerage have caused the method of private sewers to be improved. Contagious diseases would be promptly reported, and from the narrow limits of the village we know that no such diseases existed. None were reported.

The total amount expended by the board was \$6.50.

No prosecutions were brought for violations of health laws.

RAVENNA, PORTAGE COUNTY.

Lee W. Wood, health officer.

Population (estimated), 4,300.

Our streets and alleys are in a very good sanitary condition. We have what we call storm sewerage, but no sanitary sewerage. Night soil is conveyed to dump ground outside city limits in sealed casks.

Contagious diseases are generally reported, but no record kept.

Only a few vaccinated during the year. The health board meets every month. The board has expended \$500.00 including repairs on pest house.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 7 cases; typhoid fever, 6 cases; measles, 40 cases.

RAWSON, HANCOCK COUNTY.

J. J. Hawk, health officer.

Population (estimated), 923.

Ordinance before the city Council at present to more perfectly sewer the village. All night soil and garbage are removed from premises and deposited outside of corporate limits.

There have been five meetings of the board during the year. Board of health was newly organized, December 19th, 1899.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 2 cases; other infectious diseases, 4 cases.

READING, HAMILTON COUNTY.

Riley Murphy, health officer.

Population (estimated), 4,000.

The sanitary condition of the streets and alleys of this village is excellent. We have very little trouble with sewerage. All nuisances reported to the board have been successfully abated. Garbage is removed under supervision of village council, to a point outside the corporate limits of the village. Night soil is removed under the supervision of the health officer.

All contagious diseases are promptly reported, and no trouble has been experienced in enforcing the rules of the board in this respect.

Estimated number of vaccinations during year, 25. Have found it impossible to ascertain the exact number of unvaccinated children attending school. Would estimate it at about 80 per cent.

The board of health meets regularly once every month. Total amount spent by the board for the year was \$168.00. No prosecutions were found necessary.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 3 cases; measles, 12 cases.

REPUBLIC, SENECA COUNTY.

Dr. F. C. Gilcher, health officer.

Population (estimated), 550.

The board of health has maintained an active organization, and has been successful in enforcing measures for prevention of contagious diseases and for the abatement of nuisances.

The outbreaks of scarlet fever were very mild and were put under quarantine as soon as reported, and consequently there was no spread. We keep a record of all contagious diseases reported as well as all doings of the board and health officer.

The amount spent by the board of health was about thirty-five dollars for the past year. We have brought no prosecutions against any one.

Infectious diseases reported during the year: Scarlet fever, 5 cases.

RICHMOND, LAKE COUNTY.

John W. Stalker, health officer.

Population (estimated), 300.

Streets, alleys and yards are in a cleanly condition. One sewer in the village. Little or no cause for complaint. The board has been able to abate all nuisances within its jurisdiction. No arrangements for disposing of night soil beyond requiring citizens to dispose of same.

There have been no contagious diseases during this year, and arrangements are made for reporting same when they occur.

Very few, if any of the school children have been vaccinated.

Only three meetings of the board have been held during the year. One hundred and thirty dollars have been spent by the board during the year. No prosecutions have been necessary.

RIDGEWAY, HARDIN COUNTY.

Dr. E. B. Crow, health officer.

Population (estimated), 500.

Sanitary condition good. Streets, alleys and yards in excellent condition. No nuisances, garbage cared for by street commissioner. Contagious diseases reported when any exist. None to report during 1899. Nearly all of our children have been vaccinated.

Only two regular meetings of the board were held last year, but several informal ones. No prosecutions. \$26.00 spent last year.

Council keeps streets and alleys in condition and removes garbage, this by order and under the supervision of the health officer.

RIPLEY, BROWN COUNTY.

G. M. Robb, health officer.

Population (estimated), 3,000.

The sanitary condition of the city is good. Contagious diseases are properly reported and record is kept. The percentage of unvaccinated children is about 25.

The board has held eight meetings during the year. The amount spent by board \$900.00.

Contagious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 2 cases; typhoid fever, 4 cases; small-pox, 7 cases; whooping cough, 20 cases.

ROCKY RIDGE, OTTAWA COUNTY.

Wm. Schlegel, health officer.

Population (estimated), 400.

The sanitary condition of the town is good. Contagious diseases are properly reported and a record kept. Restrictive measures are enforced. Scarlet fever has been more prevalent than usual. Estimated number of people vaccinated, ten. There are sixty unvaccinated children attending school.

The board of health held two meetings. No prosecutions were brought.

Infectious diseases reported during the year: Scarlet fever, 2 cases.

ROCKFORD, MERCER COUNTY.

O. Hedges, health officer.

Population (estimated), 1,500.

Board of health has not much to report this year. Has held three regular meetings. Have had one case of diphtheria reported, resulting in death. No further spread of disease.

Sanitary condition of village is fairly good, with very good sewerage. Such is about the condition of the village at present, with no contagious disease in sight.

Infectious diseases reported during the year: Diphtheria, 1 case.

ROGERS, COLUMBIANA COUNTY.

C. T. McArtor, health officer.

Population (estimated), 500.

Our streets, alleys and yards are in a cleanly condition. There is some complaint about unfinished sewers. Night soil and garbage is hauled outside the corporation and buried.

Contagious diseases are properly reported, but no record was kept. Restrictive measures were enforced. All school children were vaccinated a year ago.

The board has held five meetings. It has not been necessary to bring any prosecutions.

Infectious diseases reported during the year: Typhoid fever, 1 case.

ROCHESTER, LORAIN COUNTY.

Dr. J. C. Dignan, health officer.

Population (estimated), 225.

The village being small there is no trouble in maintaining a cleanly condition of streets and yards. There is no lack of proper drainage. The board has successfully abated such nuisances as offensive closets, removal of stable manure, and garbage. Each property owner being responsible for the sanitary condition of his premises.

The suspected small-pox is the only case of contagious disease reported for the year, where restrictive measures were used. The vaccinations did not exceed a half dozen. No prosecutions. No expenses. 83 unvaccinated pupils.

ROSEVILLE, MUSKINGUM COUNTY.

G. B. Weaver, health officer.

Population (estimated), 1,200.

Streets, alleys and yards are not in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to abate.

Contagious diseases are properly reported and a record kept. Restrictive

measures have been enforced. Typhoid fever has been more prevalent than usual. About two hundred and sixty-five persons were vaccinated during the year. There are thirty-five unvaccinated pupils attending the schools.

The board has held four meetings and spent \$27.00.

RUSHVILLE, FAIRFIELD COUNTY.

W. G. Lewis, health officer.

Population (estimated), 350.

The sanitary condition of village is good. All nuisances reported have been abated.

Contagious diseases are generally reported. No record is kept.

Restrictive measures are enforced.

Fifty per cent. unvaccinated.

Board has held four meetings. Fifteen dollars spent by board.

Infectious diseases reported during the year: Whooping cough, 1 case.

ST. LOUISVILLE, LICKING COUNTY.

Population (estimated), 400.

The sanitary condition of our town is good. There have been no nuisances which the board has unsuccessfully tried to abate. An ordinance compels the removal of night soil and garbage.

Contagious diseases are properly reported and a record kept.

Estimated number of persons vaccinated during the year, none.

Infectious diseases reported during the year: Typhoid fever, 1 case.

ST. MARYS, AUGLAIZE COUNTY.

Dr. B. E. Thomas, health officer.

Population (estimated), 6,000.

It is impossible for me to fill out mortality report correctly, as we have been unable to get physicians to report deaths.

We carry out the rules of State Board of Health strictly in contagious diseases.

Have held monthly meetings during the year. Have spent about \$250.00 during year.

Our town is in need of a sewerage system *badly*. Have had trouble with cesspools during year and have prohibited the building of any more.

Streets and alleys are kept in a sanitary condition. Night soil and garbage is carted beyond the village limits.

Infectious diseases reported during the year: Diphtheria, 10 cases; membranous croup, 1 case; scarlet fever, 8 cases.

ST. BERNARD, HAMILTON COUNTY.

Dr. B. Pulskamp, health officer.

Population (estimated), 3,000.

Streets and alleys are kept in good condition.

There is no sewerage system, but the board has recommended it to village council and they are now considering it.

Garbage is collected weekly together with ashes and is used for filling.

Measles and chicken-pox are often not reported because no physician attends.

No special record is kept of contagious diseases, only as given in my monthly report to the board of health. Number of persons vaccinated, about 25.

Infectious diseases reported during the year: Typhoid fever, 4 cases; measles, 49 cases.

SALEM, COLUMBIANA COUNTY.

Dr. F. T. Miles, health officer.

Population (estimated), 9,000.

No report.

Infectious diseases reported during the year: Diphtheria, 13 cases; scarlet fever, 9 cases; typhoid fever, 28 cases; small-pox, 1 case; whooping cough, 1 case; other infectious diseases, 1 case.

SALESVILLE, GUERNSEY COUNTY.

W. E. McKinley, health officer.

Population (estimated), 400.

We have a working board of health.

Sanitary condition of town good.

Contagious diseases are always reported and record of same kept.

Number of unvaccinated children, 75.

Board has held only one meeting during the past year. Health of town has been good.

Infectious diseases reported during the year: Typhoid fever, 2 cases.

SALINEVILLE, COLUMBIANA COUNTY.

James Carter, health officer.

Population (estimated), 3,000.

Streets, alleys and yards in good condition. Two open sewers requiring constant attention. Have been successful in abating all nuisances.

Disposition of night soil — when vault is full ordered covered with soil, new vault dug and privy moved.

Contagious diseases reported and recorded. Never had so few for several years. Some three or four years ago all the school children were vaccinated. No vaccinations since to my knowledge.

The board has had ten regular and three special meetings. Total amount spent for the year, \$132.00.

Have had no prosecutions for violations of orders or health laws.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 4 cases.

SANDUSKY, ERIE COUNTY.

Dr. W. H. Busch, health officer.

Population (estimated), 22,000.

The board of health meets the second and fourth Tuesday of every month, and has maintained an active organization during the entire year.

The sanitary condition of the city is very good.

The contagious diseases are properly reported and a record of all such diseases is kept.

Upon report of contagious diseases by physicians all such houses are placarded and all proper restrictive measures enforced. Scarlet fever has been more prevalent than usual. General vaccination was enforced in all the public and parochial schools last September, before admittance to school.

The board has spent \$9,222.76 during the year.

Infectious diseases reported during the year; Diphtheria, 14 cases; membranous croup, 15 cases; scarlet fever, 83 cases; typhoid fever, 7 cases; small-pox, 78 cases; measles, 18 cases; other infectious diseases (chicken-pox), 51 cases.

SCIO, HARRISON COUNTY.

Joe Wells, health officer.

Population (estimated), 2,500.

We have good water works system, but very imperfect sewerage system. Last summer the disposition of garbage was a very serious question. We leased a plot of ground and buried it in trenches. We had at that time some five or six thousand people in the village and had the usual degree of health. The population has dwindled to about one-half the former figure.

We have succeeded fairly well in having streets, yards and alleys cleaned up. Not in perfect condition, however. Have been largely able to enforce our orders. We bury garbage and night soil.

I believe we had nine meetings last year. The amount expended by the village last year for board of health would aggregate near \$100.00.

I prosecuted one case of vending spoiled meat contrary to village ordinance.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 2 cases; typhoid fever, 6 cases; measles, 10 cases.

**SCOTT, VAN WERT AND PAULD-
ING COUNTIES.**

W. M. Worthington, health officer.
Population (estimated), 600.

The village of Scott is in fair sanitary condition. Sewerage is fairly good. Two nuisances were abated.

Night soil and garbage is removed at night in barrels.

Contagious diseases are not properly reported. A record of such diseases is kept. The board has been able to enforce restrictive measures.

One hundred and eighty pupils in school not vaccinated — two hundred and sixteen in school.

Ten board meetings were held during the year.

No prosecutions were brought by the board. Amount spent by board, \$2.25.

Infectious diseases reported during the year: Whooping cough, 25 cases; other infectious diseases, 50 cases.

**RUSSELLVILLE, BROWN
COUNTY.**

J. G. Miller, clerk.
Population (estimated), 400.
No report.

**SENECAVILLE, GUERNSEY
COUNTY.**

Dr. W. Scott, health officer.
Population (estimated), 600.
No report.

SEVEN MILE, BUTLER COUNTY.

John Thomas, health officer.
Population (estimated), 500.

This board of health consists of three councilmen. Meetings first Monday of each month. The village clerk keeps a record of their transactions.

Contagious diseases have been properly reported. No record has been kept, but we intend to hereafter.

The number of unvaccinated children in our village school is fifty (50).

SHAWNEE, PERRY COUNTY.

E. C. Mann, health officer.
Population (estimated), 4,000.

Our town is so situated that there is, to a large extent, natural drainage.

Our streets and alleys, being constructed largely of mill cinders, are in fairly good condition during the year with exception of a few months during the winter season.

Our board has maintained an active organization and has been successful in enforcing proper measures to control the spread of contagious diseases, also the abatement of nuisances.

The number of cases of measles reported was large, but of a mild form and with one exception of a very young infant who died of spasms induced by measles, there were no fatalities. Scarlet fever was quite prevalent, but, like the measles, was not as serious as it might have been. The few cases lost were complicated with other trouble.

There were five cases of diphtheria reported, two of which were fatal. Antitoxin was used in both of these fatal cases.

All houses with infectious diseases within were properly placarded, quarantined and disinfected.

During this period and continuing through winter months school houses were disinfected three or four times a week.

We use a spray disinfectant (creolin, cor. sub. formaldehyde, etc.), and in the more serious cases, especially diphtheria, the formalin gas.

The number of notices for the abatement of nuisances was nineteen, nearly all of which were obeyed and the condition of places improved by renovation, required by the board.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 5 cases; scarlet fever, 30 cases; typhoid fever, 4 cases; measles, 50 cases.

SHELBY, RICHLAND COUNTY.

Dr. W. S. Anderson, health officer.

Population (estimated), 6,000.

Streets, alleys and yards are fairly clean. Sewer system is not completed, but should be soon, in order to give good drainage to cellars that cannot be otherwise drained. The board has been successful in removing all nuisances so far. Have a licensed privy cleaner whose license can be revoked if there is sufficient cause. No disposition of garbage yet.

Contagious diseases are all reported (except measles and mumps), record is not properly kept. Restrictive measures have always been enforced. Scarlet fever prevalent in first part of 1899. A small number of typhoid cases during the fall of 1899. No children vaccinated.

Board has not held more than six meetings during the year. About \$50 outside of regular salaries which amount to \$165.00. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 55 cases; typhoid fever, 15 cases; whooping cough, none reported; measles, none reported.

SHREVE, WAYNE COUNTY.

John R. Wachtel, health officer.

Population (estimated), 1,200.

The present board of health was appointed and organized June 6, 1899.

The present sanitary condition of the village is good and since the organization there have been no contagious diseases in the community. Streets, alleys and yards in a good condition. Have good surface sewerage; one underground sewer which does its work well. There were no nuisances which the board unsuccessfully tried to abate. Night soil and garbage removed in sealed barrels.

Contagious diseases are promptly reported. Board, in the only case reported, used proper methods. Esti-

mated number vaccinated, 214. Number unvaccinated in schools, 95.

Board meetings first Tuesday in each month. Amount spent since June \$15. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 1 case.

SIDNEY, SHELBY COUNTY.

Wm. C. Wyman, health officer,

Population (estimated,) 6,000.

Sanitary condition of Sidney at the present time is not good. Streets, alleys and some yards are in a very bad condition, mostly on account of lack of sewerage, together with bad weather. The board has abated all nuisances. No arrangements have been made by the city for the disposition of night soil. We issue permits to those having proper barrels for the purpose, and they take it out in the country and dispose of it on farm land. As to garbage, it is used in low places to fill up, and the lighter stuff burned.

Contagious diseases are properly reported where there is a doctor employed. Only a memorandum of such kept at present. Proper restrictive measures have been enforced. Whooping cough has been wide spread. The parents having no doctor and failed to report. Until it gets a good start. It is now abating. Dr. Cox, Superintendent of public schools reports 675 unvaccinated pupils attending, and Sister Francis de Sales of the Catholic parochial school reports 136 unvaccinated children attending.

The board met seven times during the year, the business being attended to by the health officer and the different committees and the sanitary officer. No prosecutions. The total expenditure for the year was \$276.79.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 2 cases; typhoid fever, 5 cases; whooping cough, 24 cases; measles, 4 cases; other infectious diseases, chicken-pox, 3 cases.

SMITHFIELD, JEFFERSON COUNTY.

N. O. Phipps, health officer.
Population (estimated), 625.

Our regular board of health organized some years ago has gone out of existence and our village council acts in matters pertaining to sanitary affairs. Our marshal, N. O. Phipps, acting under orders of council, notifies owners of property to remove filth or noxious material reported as deleterious to health, and so far no trouble has occurred. Our town lies on a ridge eight miles from the Ohio river and about 550 feet above it. The natural drainage cannot be excelled, consequently we have no trouble about sewerage or cesspools.

No contagious diseases have occurred during the year except a few cases of chicken-pox among children. Almost all the children have been vaccinated. No expenditures for sanitary purposes.

SMITHVILLE, WAYNE COUNTY.

Dr. D. H. Morgan, A. M., health officer.

Population (estimated), 500.

The streets are clean from a sanitary point of view; a few alleys contain some large manure piles, but do not know that the public health is thereby endangered. A few houses have not sufficient drainage, and the waters dam back during the wet season. No complaints made of any nuisances and none abated. Garbage is buried privately, or thrown out with the sewage.

Contagious diseases are properly reported except in the cases where no physician is called. Parents and guardians do not seem to understand the responsibilities in such emergencies. Several cases of whooping cough had to be looked up by the health officer and explanations made to parents. No special trouble in enforcing quarantine rules. Scarletina and whooping cough most prevalent. Probably no one vaccinated. Probably all school children have not been vaccinated.

One regular meeting and several informal meetings of members. No money expended. No prosecutions made during the year 1899.

Infectious diseases reported during the year: Scarlet fever, 3 cases; whooping cough, 6 cases.

SOUTH CHARLESTON, CLARK COUNTY.

Dr. C. A. Grahn, health officer.
Population (estimated), 1,200.

We consider the sanitary condition fairly good. Streets, alleys, yards and sewerage in good shape. Contagious diseases are properly reported and cared for. Very few of the people will submit to vaccination due to newspaper reports of serious results due to vaccination.

Board held three meetings. Money spent \$70.60. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 2 cases; whooping cough, 7 cases.

SOUTH BLOOMFIELD, PICKAWAY COUNTY.

Dr. Chas. E. Blacker, health officer.
Population (estimated), 250.

At regular meeting of board of health, Jan. 3d, 1899, I was sent as a delegate to ninth annual meeting of State and Local Boards held in Columbus, Jan. 19, and 20. Jan. 16th, made out health officer's report and sent to Secretary State Board. Feb. 21, was called to see a lady who had washed—her week's washing—on the porch that day and felt "awful" bad, temperature $103\frac{1}{2}$, in two days the fever was all gone but she remained quite weak, on the 25th of same month, her six year old girl was taken suddenly sick with vomiting and temperature of $103\frac{1}{2}$, a plain case of scarlet fever. Her mother had brought it from Lockbourne. Got it by cleaning up a house which had been—supposedly—properly disinfected after containing cases of scarlet fever. This family was properly quarantined and

lived up to it. But scarlet fever was probably in two other families—though I did not see the cases.—In these other families I felt quite certain the quarantine was ineffectual.

Three cases I attended, and one each in the other two families.

On Feb. 23d, John White, aged 17, arrived from Mifflin township, Franklin county, O., sick. I saw him first on the 26th,—a plain case of measles. I thought I had him properly quarantined but the family of one of the members of the board of health succeeded in not only stealing the measles, but in also infecting the whole town. There being probably more than 40 cases, none of them being fatal, and many of them not seen by a physician during their sickness. One woman—about to term—came near choking to death and her baby born at this time did die within two weeks in the same way i. e., by strangulation.

After the first case of measles there was no attempt at quarantine, neither was there any attempt at quarantining in the epidemic of whooping cough which followed the measles. There were from 40 to 50 cases pertussis.

There is no 'esprit de corp' in our board of health and during the past year the council has been altogether 'cranky' on pebbling the gutters and spent all of the money in this way. so that after receiving the February distribution, the entire sum in the town treasury will not meet the outstanding indebtedness. Neither the board of health nor council has spent any money for sickness or its prevention.

The infirmary directors—through the township trustees—paid \$7.00 for the John White case. I have a bill of \$3.50 for four items in disinfectants for others and disinfecting premises myself not yet presented.

The board of health has not met oftener than half a dozen times, within the year. The organization is in the most deplorable condition it has ever been in since its first formation. It owes its clerk \$5.00 for a year's service that be-

ing his salary by stipulation. I have attempted well nigh nothing because of the uselessness of such an attempt. There is in fact no money; has been none; except for gutters—nor will there be any to spare even after the August distribution. It is so hard to get the right kind of men on the board. I have plenty of reason to believe that the last appointee sought his appointment because he wanted a position where his voice against quarantining would be counted.

Our subsoil and natural drainage are superb, therefore our sanitary condition is quite good. According to the best of my memory there have been no nuisances reported. Most of this winter I have been fully engrossed in pursuits and with cares not professional, hence it has been extremely difficult for me to furnish this report.

P. S. In December of 1893 and Jan. of 1894, I vaccinated all of the unvaccinated school children 53 in number. I have not known of half dozen vaccinations in this village since that time.

SPARTA, MORROW COUNTY.

S. G. Fowls, health officer.
Population (estimated), 210.

Sanitary condition of the village is good. Streets and alleys are in good condition.

No contagious diseases occurred during the year. None vaccinated. No money spent by the board.

Infectious diseases reported during the year: Whooping cough. 20 cases.

SPENCERVILLE, ALLEN COUNTY.

Chas. H. Baum, health officer.
Population (estimated), 2,000.

Board is in active operation and meets once every month. Sanitary condition is very good and great caution is taken in contagious diseases and abating nuisances. Streets, alleys and yards are

in clean condition. There is cause for complaint as to our sewerage and improper discharge of sewage. Our sewerage enters the Fisher ditch, emptying into the canal, which when high causes the water to back up and form stagnant pools in the ditch. We have tried to abate this nuisance, but have been unsuccessful. Garbage is disposed of on grounds outside the village.

Contagious diseases are reported and a record is kept.

The board held eight meetings. Amount spent, \$40.00. No prosecutions were brought by the board.

Infectious diseases reported during the year: Membranous croup, 2 cases; typhoid fever, 2 cases.

SPRINGBORO, WARREN COUNTY.

Jas. B. Haines, health officer.

Population (estimated), 500.

The streets, alleys and yards are in a cleanly condition. The sewerage is good. There are no nuisances which the board has unsuccessfully tried to abate. No arrangements are made for the removal and disposition of night soil and garbage..

Contagious diseases are not properly reported. The board has been able to enforce proper restrictive measures to some extent. Measles has been more prevalent than usual. Eighty-five or ninety persons were vaccinated during the year. There are about 20 unvaccinated children attending public school.

The board of health has held seven meetings during the year. Total amount spent, \$12.25. No prosecutions brought by the board of health.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 11 cases; measles, 22 cases.

SPRINGFIELD, CLARK COUNTY.

Dr. H. H. Seys, health officer.

Population (estimated), 45,000.

Streets, alleys and yards are not in a cleanly condition. Garbage is hauled in

wagons two and one half miles from the center of the city. Night soil is disposed of by private contract.

All contagious diseases except whooping cough and typhoid fever, are reported, and a record is kept. There has been more typhoid fever than usual and have had some small-pox. There are very few children attending school who have not been vaccinated. The board of health is the board of public affairs, which meets every week. Cannot give amount expended for sanitary purposes during the year, probably about \$4,500.00. No prosecutions were brought during the year.

Infectious diseases reported during the year: Diphtheria, 12 cases; membranous croup, 14 cases; scarlet fever, 123 cases; small-pox, 12 cases; measles, 110 cases.

SPRING VALLEY, GREENE COUNTY.

Arch Copsey, health officer.

Population (estimated), 800.

The town is in good sanitary condition. The sewerage at present is in good condition. We do not allow any nuisances to continue very long at a time before we go after them.

All contagious diseases are reported to me and are seen after at once.

The board of health meets once a month. Twelve meetings were held last year. The expenses of the board for the year were \$45.25.

Infectious diseases reported during the year: Typhoid fever, 1 case.

STRASBURG, TUSCARAWAS COUNTY.

Dr. J. C. Schutzbach, health officer.

Population (estimated), 525.

About 50 per cent are not vaccinated. Streets and alleys are kept clean. All contagious diseases are not reported.

Board has monthly meetings. Total amount expended, \$25.00.

Infectious diseases reported during the year: Diphtheria, 2 cases; mem-

branous croup, 4 cases; scarlet fever, 5 cases; typhoid fever, 6 cases; whooping cough, 27 cases; other infectious diseases, 9 cases.

SUGAR GROVE, FAIRFIELD COUNTY.

S. Renshaw, health officer.

Population (estimated), 500.

The excellent sanitary condition of our village last year has been maintained and at present is very good.

Except a few cases of measles we had no contagious diseases to deal with. Physicians have promptly reported contagious diseases and the board has taken proper measures to prevent their spread.

Board meets monthly.

There have been no children vaccinated for several years. There are probably over one hundred children unvaccinated.

The board expended \$20.00 for secretary's services.

Infectious diseases reported during the year: Measles, 6 cases.

SUMMERFIELD, NOBLE COUNTY.

A. G. Wharton, health officer.

Population (estimated), 600.

I have been health officer for only about half of the last year. The sanitary condition of our village is good as it is located on a dividing ridge and has good natural drainage.

Contagious diseases are properly reported. The board has been able to enforce restrictive measures. Measles have been very prevalent during the past year, but the people did not seem to want the disease checked, so there was no effort made by the board to stop its spread.

The board has only held one meeting in the past six months. No prosecutions.

Infectious diseases reported during the year: Typhoid fever, 7 cases; measles, 100 cases.

SUNBURY, DELAWARE COUNTY.

Dr. J. H. Gerhardt, health officer.

Population (estimated), 500.

The sanitary condition is fairly good. All contagious diseases are properly reported. About four meetings held during the year. About 20 have been vaccinated during year. There are not more than about ten or fifteen unvaccinated children in the schools.

Infectious diseases reported during the year: Smallpox, 3 cases.

SYLVANIA, LUCAS COUNTY.

G. A. Crandall, health officer.

Population (estimated), 650.

The streets, alleys and yards are as clean as could be expected at this season of the year. There is no complaint concerning sewerage. There are no arrangements for the disposal of night soil or garbage.

Contagious diseases are properly reported and a record kept. The board has been able to enforce restrictive measures. Scarlet fever has been more prevalent than usual. There are sixty-four unvaccinated children attending the public schools. Eight meetings of the board were held and \$28.50 expended.

Infectious diseases reported during the year: Scarlet fever, 23 cases.

SYCAMORE, WYANDOT COUNTY.

R. S. Galleher, health officer.

Population (estimated), 900.

For the last year our village has been kept in a good sanitary condition. We have had but very little sickness. More scarlet fever, as you will notice, than any other trouble and always in a mild form. No deaths have resulted from said disease.

We have not expended any money directly for sanitary purposes as the village authorities keep the streets and alleys in good condition and aside from

a few private lots we have not been compelled to enforce the rules of the health board.

Our board has held I think, six meetings during the year. These have been called in connection with some trivial matter. The health of our citizens has never been better than the last year. In cases of contagious diseases we have maintained quarantine, and on recovery of patient have thoroughly disinfected the premises. There has been no vaccination so far as I can learn and quite a number of the school children are not vaccinated, cannot give the exact number. We have had no litigation of any kind during the year, and the citizens generally are willing to obey any reasonable order of the board. I keep a record of all diseases reported to this office and the ones noticed in this report are the only reported cases during the year and no death from any of the causes named.

Infections diseases reported during the year: Membranous croup, 1 case; scarlet fever, 28 cases.

The above are all cases reported to this office during the year 1899.

THORNVILLE, PERRY COUNTY.

W. T. Stevens, health officer.

Population (estimated), 600.

No report.

TIFFIN, SENECA COUNTY.

Dr. A. C. Schwartz, health officer.

Population (estimated), 15,000.

All streets, alleys and yards are clean. No cause of complaint from lack of sewerage, but of discharge of sewage. We abate all nuisances as they arise. We have a garbage contractor who is paid \$125 per month for the 4 summer months, and \$62.50 for the remaining 8 months. He is under bond to remove all garbage and tin cans, gives good satisfaction. We also have a scavenger who removes all night soil beyond city limits, and disposes of it by

ploughing it under. He charges the property owner 50 cents per barrel.

All contagious diseases are reported, and a record is kept. We are able as a rule to enforce restrictive measures. Scarlet fever, diphtheria and measles have been more prevalent than usual. About 200 people were vaccinated during the year. About 1400 unvaccinated children attend school.

The board of health has held eighteen meetings. Total amount spent during year, \$2,573.47. We had to prosecute no one.

Infectious diseases reported during the year: Diphtheria, 17 cases; membranous croup, 3 cases; scarlet fever, 64 cases; typhoid fever, 43 cases; measles, 40 cases, other infectious diseases, 5 cases.

TIPPECANOE CITY, MIAMI COUNTY.

Est. S. Smith, health officer.

Population (estimated), 1,600.

Streets, alleys and yards are in a cleanly condition. There is no complaint in regard to sewerage. Contagious diseases are properly reported but no record is kept. Restrictive measures are enforced. Scarlet fever has been more prevalent than usual. There are fifty unvaccinated children attending the public schools.

The board held five meetings and spent \$52.00.

Infectious diseases reported during the year: Scarlet fever, 2 cases.

TIRO, CRAWFORD COUNTY.

Dr. W. H. Guiss, health officer.

Population (estimated), 300.

The streets and alleys are in good sanitary condition. We have no sewer system. We have no nuisances that we have failed to abate. There are no arrangements to remove night soil or garbage.

Contagious diseases are not reported to the health officer, no record is kept.

The board has been able to enforce proper restrictive measures. No vaccinations during the year.

The board of health has had four meetings during the year and adjourned at the call of the president. No prosecutions were brought during the year.

Infectious diseases reported during the year: Scarlet fever, 10 cases, typhoid fever, 18 cases.

TOLEDO, LUCAS COUNTY.

Dr. L. C. Grosh, health officer.

Population (estimated), 150,000.

The sanitary condition of Toledo is fair. Our board has been an active organization, and has been able to control contagious diseases, and procure the abatement of nuisances. The sewerage of the city is fair, but not complete. Night soil is removed by licensed men and removed by them from the city. Garbage is collected by contract let by common council and deposited on a dump.

Contagious diseases are reported properly, except typhoid fever and tuberculosis. A record is kept. The board has been able to enforce restrictive measures. The contagious diseases most prevalent have been diphtheria, scarlatina, and measles. The number vaccinated is about 450. The superintendent of schools does not know the number of unvaccinated school children.

The board of health has held twenty meetings. The total amount spent by the department was \$15,131.31.

Prosecutions brought by Department of Health:

I. Emptying contents of vault in alley. Fined and paid cash \$4.75.

II. Private collector, dumping garbage in alley. Case nullified.

III. Keeper of dairy farm fined for permitting night soil to be dumped on it. Fined \$10 and costs of \$5.01 paid.

IV. Preserved and low grade milk. Fined \$50 and costs, paid \$57.75.

V. Preserved and low grade milk. Fined \$50 and costs, paid \$57.75.

VI. Preserved and low grade milk. Fined \$75.00, paid.

VII. Entering house carded for contagious disease. Fined \$20.00 and costs.

VIII. Opening a house while fumigation was going on. Fined \$10.00 and costs.

IX. Removing card from house that was quarantined. Fined \$10 and costs.

X. Entering house that was placarded and quarantined. Fined \$5.00 and costs.

XI. Depositing night soil on ground. Fined \$5 and costs, all \$7.72 workhouse.

XII. Improper vault. \$5.00 and costs.

XIII. A doctor of medicine for not reporting diphtheria. Paid costs \$5.87.

XIV. For removing quarantine placard. \$5.00 and costs.

XV. Visiting and allowing people to enter placarded and quarantined house. \$5.00 and costs, each paid.

Infectious diseases reported during the year: Diphtheria, 709 cases; membranous croup, 65 cases; scarlet fever, 681 cases; typhoid fever, 24 cases; small-pox, 9 cases; measles, 708 cases; other infectious diseases, (chicken-pox) 20 cases.

TROY, MIAMI COUNTY.

Dr. E. N. Loy, health officer.

Population (estimated), 6,000.

The streets and alleys are in a good sanitary condition. The only nuisance we have been unable to abate is the garbage. The city council makes no provision for its disposal.

All contagious diseases have been reported and a record kept. During the past year there has been only a very small number of vaccinations. The local board of health has taken no action in regard to it and made no suggestions. It has not been practical for me to learn the number of school children that have been vaccinated.

The board of health has had twelve meetings during past year and the total expenditure amounts to about \$225.

No arrests have been made.

Infectious diseases reported during the year: Scarlet fever, 38 cases.

UHRICHSVILLE, TUSCARAWAS
COUNTY.

Dr. James A. McCollam, health officer.

Population (estimated), 5,000.

We feel that we have great reason to feel encouraged as to sanitation. Our citizens are becoming educated as to sanitary affairs. We still have great room to improve. We feel the need of sanitary sewerage, yet are glad to say that we have had about 5,000 feet of sanitary sewer constructed this year and more arranged for in 1900. Our streets and alleys are not good, but considering the conditions we have reason to be proud. In the average back yard there could be considerable improvement.

As a rule physicians are very prompt in reporting contagious diseases. We have had quite a number of cases of typhoid fever. Through the latter part of '99 and until this time Jan. 24th, 1900 whooping cough has been epidemic. The most general we have ever known. We have had quite a number of cases of chickenpox, usually no doctor is called and cases are not reported. We have had no trouble with quarantine regulations. I only know of three vaccinations.

Our board has held six meetings this year, and spent \$150.00. The board brought three prosecutions; two for violation of scavenger regulations, both convicted and fined; and one for maintaining a nuisance, agreed not to push the case if nuisance was abated. (Case continued.)

Had one warrant issued three or four months ago for violation of scavenger regulations. Police have not arrested him yet. We have issued a license to a scavenger to remove night soil, he to arrange for disposal. The superintendent of public schools refused to ask the children about vaccination to find how many had not been vaccinated unless ordered by the school board. He says that a year ago the school board told him not to try to find out as the children might be scared.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 1 case; scarlet fever, 12 cases; typhoid fever, about 55 cases.

UNION CITY, DARKE COUNTY.

James F. Bolen, health officer.

Population (estimated), 1,500.

The streets, alleys and yards with but few exceptions are in a good sanitary condition. There has been complaint made from the lack of sewerage from residents in northern part of village, whether just or not will be determined by the courts, as the village is defendant in a suit wherein the plaintiff alleges insufficient sewerage. The board of health, however, was not brought into the case. There has been no other complaints concerning sewerage, and I think we have a fair system of sewerage. The board has dealt successfully with all nuisances during the year, and all orders of the board have been promptly complied with.

The disposal of night soil is done under the provisions of Section 6923 of the Revised Statutes and under the direct supervision of the health officer.

All contagious diseases are properly reported, a record of same kept, and proper measures immediately taken for the prevention of spread. The disease most prevalent during the year was typhoid fever, there being two deaths from same.

The estimated number of persons vaccinated during the year was 15. The total number of unvaccinated pupils attending the public schools as ascertained by the superintendent is 187.

The board has held nine meetings during the year and have at the present time an active organization, and have been successful in enforcing the proper measures for the prevention of contagious diseases and the abatement of nuisances. No prosecutions have been brought by the board for violation of its orders during the year. The board's expenditures during the year amounted to \$125.00.

Infectious diseases reported during the year: Typhoid fever, 5 cases; whooping cough, 3 cases; measles, 2 cases.

UNIONVILLE CENTER, UNION COUNTY.

Dr. C. O. McCune, health officer.
Population (estimated), 350.

We had no organized board of health in 1899, but organized the first of the present year. The streets and alleys are in very good sanitary condition.

All contagious diseases were promptly reported. There were no fatal contagious diseases in the village or township. I believe the present board met every week, subject to call at any time.

Infectious diseases reported during the year: Membranous croup, 1 case; whooping cough, 14 cases.

UPPER SANDUSKY, WYANDOT COUNTY.

Dr. G. O. Maskey, health officer.
Population (estimated), 4,000.

Our streets and alleys are kept clean and well drained, but the sanitary condition of our city could be improved by a modern system of sanitary sewers. Our board of health has been very successful in enforcing any measures for the prevention and spread of disease, as well as for the abatement of nuisances. We have a dumping ground to which all night soil and garbage is carted and buried.

All contagious diseases are promptly reported, a record kept and proper restrictive measures enforced. We have had very few contagious diseases the past year and have vaccinated no children. There are four hundred children in our schools that have never been vaccinated.

The board of health is composed of successful business men, and they maintain an active organization during the year and meet as often as necessary. The health department costs the city about \$200 per year.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 4 cases; typhoid fever, 4 cases; whooping cough, 18 cases; measles, 20 cases.

URBANA, CHAMPAIGN COUNTY.

Dr. C. C. Craig, health officer.
Population (estimated), 8,000.

The Urbana board of health has been and is an active organization and have been successful in enforcing its laws. Streets, alleys and yards are kept clean by sanitary police. We have no sewerage and naturally have extra work in keeping the city in proper sanitary condition. The board has successfully abolished all nuisances reported or found by sanitary policemen.

Night soil is removed at night by men well prepared for the work and taken to the country and buried.

All contagious diseases are reported and a record is kept of same. Board has had no trouble in enforcing restrictive measures. There have been no unusual contagious diseases this year. Estimated number of persons vaccinated during year, 300. Have not been able to get report from schools regarding number unvaccinated. But should say that there are very few, as we have enforced vaccination whenever reason for it.

The board of health has held six meetings during the year. Total expenditure of board \$400. There have been no prosecutions.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 7 cases; typhoid fever, 4 cases; whooping cough, 10 cases; measles, 22 cases.

UTICA, LICKING COUNTY.

Dr. G. W. Garrison, health officer.
Population (estimated), 1,000.

Our streets, alleys and outbuildings are all in as good condition as it is possible to have them in a country town. Had but one contagious disease, scarla-

tina; the case was promptly reported and the family quarantined.

Board of health has been quite derelict in having regular meetings during the past year, leaving all the business to myself, there being no epidemic, etc. No prosecutions, expended something like \$15.00 all told for sanitary purposes. Some dead animals had to be buried and the like. My salary allowed is but \$10.00 per year.

Infectious diseases reported during the year: Scarlet fever, 1 case.

VAN BUREN, HANCOCK COUNTY.

N. W. McCaughy, Mayor.
Population (estimated), 400.

The sanitary condition of our village is good. We are situated on high ground with good fall. The general health is good. We have a board of health here but it is hard to keep it organized as there is very little to do.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 2 cases.

VANDALIA, MONTGOMERY COUNTY.

W. H. Riley, member of board of health.

Population (estimated), 350.

Sanitary condition is very good. Streets and alleys kept clean. The location of our village is such that the sewerage is first class. No nuisances reported.

Contagious diseases are not properly reported. Have had none the past year. Do not know of any vaccinations.

Board of health met and organized, elected Dr. J. M. Deam, health officer, but he has never qualified. No money spent by the board.

VANLUE, HANCOCK COUNTY.

Dr. James L. Schrote, health officer.
Population (estimated), 500.

The operations of the board of health here during the past year have been

somewhat limited. Until early winter there have been few cases of contagious diseases, and they principally of mild type. Since then we have had in the village and vicinity an epidemic of scarlatina with but a single death. The alleys and streets are kept moderately clean but privy vaults are frequently neglected. The number of unvaccinated children in our village schools is one hundred and thirty-eight, while the number of vaccinated is but nine.

Infectious diseases reported during the year: Diphtheria, 8 cases; membranous croup, 2 cases; scarlet fever, 54 cases; typhoid fever, 8 cases.

VAN WERT, VAN WERT, COUNTY.

Dr. A. B. Gilliland, health officer.
Population (estimated), 8,000.

Streets, alleys and yards are in fair condition. There is serious cause for complaint on account of lack of sewerage and improper discharge of sewage. Many privy vaults and water closets empty into common tile, or ordinary sewers that receive surface water. Two are sanitary sewers—all empty into a small creek running through the center of town, bounding the business part on two sides. This creek in summer time will contain not more than six inches deep and two or three feet wide of polluted foul smelling water, that can not help being a menace to the general health of the community. On coming into office in October, I made a careful investigation of the sewers and creek and made quite a lengthy report on the same, and recommended that a sanitary sewer be constructed. It was tabled, and recently passed over for an indefinite time on the ground that the town cannot afford it, and can get along without it for a while. It is a matter that well deserves the attention of the State Board.

There are no arrangements for the removal of garbage or night soil. A dump is owned by the town but we have

no arrangements for conveying refuse matter to it.

A record of contagious diseases has been kept during my period, since assuming office. As far as I have been able to learn, cases have been promptly reported. Quarantine has been established and well enforced. Scarlet fever and whooping cough have been the prevailing diseases. It has not been possible to keep a record of vaccinations during the year. The superintendent of the schools reports that there are 1,390 pupils in the schools and undoubtedly a great many not vaccinated, as no general vaccination has been enforced for several years.

The board of health met twice during the year as called meetings. They spent about \$300.

No prosecutions were brought by the board.

VERMILION, ERIE COUNTY.

N. C. Parker, health officer.

Population (estimated), 1,500.

The streets and alleys are in a fair sanitary shape although they might be better. The sewerage is not the best, being mostly open drains, although the past season there has been a few streets tiled and I understand that there is more to be put in this spring. The worst nuisances we have to contend with here are the fish houses and privy vaults. This town depends largely on fishing, there being several large fish houses here and they won't pay much attention to the laws in regard to the disposition of the offal, which is thrown into the river or lake and it has been impossible to catch them at it.

Until this fall the night soil has been buried in the yards. Generally, they just dig a new hole and throw the dirt over where the old one was. They tell me that this has been done ever since the village has been incorporated. I started a crusade this fall, got a man to come here and do the work and was getting along nicely until diphtheria broke out, when the board stopped the

work, thinking that was what caused the disease. Since then they don't seem to care to enforce the law and there are some bad places yet that ought to be attended to. So far as I know diphtheria was reported, though whooping cough or scarlet rash is not reported at all.

I have no book to record contagious diseases in and have no record except of deaths which are recorded in statement of death. There is also no record kept of births, no book being furnished me. The people are very much opposed to vaccination and I don't think that there is much of it done. There are 197 children attending school that are not vaccinated.

Our board meets once a month regular, and during the diphtheria outbreak we had three extra sessions. Total amount spent, \$195.00.

Infectious diseases reported during the year: Diphtheria, 6 cases.

VERSAILLES, DARKE COUNTY.

Dr. W. C. Gutermuth, health officer.

Population (estimated), 1,600.

The sanitary condition of the village is good. Night soil is removed some distance from the corporation line and is used for fertilizing. Physicians are slow in reporting some cases of contagious diseases, great trouble was experienced in the beginning of a recent epidemic of scarlet fever. One physician was cited to appear before the board for failing to report cases, he failed to appear and the matter was dropped by the board they lacking back-bone.

Twelve meetings were held during the year. The expenses of the board were about \$100.00, this amount includes salaries of health officer and sanitary policemen.

Infectious diseases reported during the year: Scarlet fever, 12 cases; measles, 2 cases.

WADSWORTH, MEDINA COUNTY.

Dr. C. N. Lyman, health officer.

Population (estimated), 2, 200.

Streets and alleys are in fair condition. There is some cause for complaint from lack of sewerage. Some families discharge their wash water into the gutters of the streets. So far the board has not been successful in the abatement of this nuisance. Night soil and garbage is collected by the scavenger and carted outside of the village, at the expense of the owner or occupant of the lot.

Diphtheria, scarlet fever and measles are well reported as a rule. There have been a number of mild cases where physicians were not called for fear of quarantine, as a result, cases of scarlet fever are cropping out at short intervals. Only one physician reports typhoid fever, the health officer gets his knowledge by inquiry. The number of unvaccinated children attending school is some 275, I called the matter to the attention of the school board during the fall vacation, but he didn't care at all, and nothing resulted.

There were eight meetings of the health board. The present board is a good one. They are all day laborers and it is difficult for them to be always present. It is more difficult to get the physicians to be prompt to report their cases, than to get the health board to act. The sanitary policeman's bill for the year was some \$33.00 as he reported to me.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 15 cases; typhoid fever, 6 cases; whooping cough, 1 case.

WAPAKONETA, AUGLAIZE COUNTY.

A. Kohler, health officer.

Population (estimated), 5,000.

Sanitary condition of the town is fair. Alleys are not in very good condition.

Contagious diseases are not always

reported. We have no sewerage system except a few private sewers and one from the court house, which empty into the Auglaize river almost in the center of the village, and there is not enough water in said river to carry off the filth. No provision is made for removing night soil or garbage.

Number of unvaccinated children attending schools 67.

The board held twelve meetings during the year and expended eighty-one dollars. (\$81.00).

WARREN, TRUMBULL COUNTY.

Dr. D. E. Hoover, health officer.

Population (estimated), 12,000.

Streets, alleys and yards are kept clean. No sewerage on Frederic and Charles streets and Niles Avenue. Can not get signatures for proper foot frontage. Law should be changed. East Market street sewer empties into river in center of town. The board has been successful in abating all nuisances they have undertaken. Night soil and garbage are carted to city dump grounds by contract and sold as fertilizer.

Contagious diseases are properly reported except whooping cough and records are kept. Proper restrictive measure are enforced.

Diphtheria and typhoid fever have been more prevalent than usual this year. From one thousand to twelve hundred persons have been vaccinated during the year. Out of three thousand school children there are from eight to ten hundred unvaccinated.

The board meets twice a month, there were twenty-three meetings. There were six arrests; three for committing nuisances; one removal of closet without permit; one, cleaning closet without permit; and one for failure to report an infectious disease. All fined.

Infectious diseases reported during the year: Diphtheria, 11 cases; scarlet fever, 3 cases; typhoid fever, 12 cases; measles, 6 cases; other infectious diseases, chicken-pox, 13 cases.

WASHINGTON C. H., FAYETTE COUNTY.

J. M. Edwards, health officer.

Population (estimated), 7,121.

Our board of health has not held regular meetings, but meet at the call of the president. Have had no difficulty in enforcing the regulations of the board. As a rule our people willingly comply with orders of the board or of the health officer. Our streets and alleys are kept clear of everything that might be injurious to health. The great want of this city is a system of sewerage. Paint creek runs through the city and what sewers we have empty into this stream. Night soil from the densely peopled part of the city is carried by sewers into the creek. The sparsely populated part of the city takes (each lot holder) care of their night soil. Between our sewers and the refuse from a soap factory, thousands of fish are killed in the creek every summer. Notwithstanding the drouth last summer and fall we had less sickness than usual.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 2 cases; typhoid fever, 5 cases; measles, 5 cases.

WATERVILLE, LUCAS COUNTY.

Dr. Samuel Downs, health officer.

Population (estimated), 750.

I have been waiting for the Mayor to organize a new health board, which has just been done. They will meet the first Saturday of every month. The new board has not yet adopted its rules and regulations, but expects to at its next regular meeting. There has been no organization during the past year, hence no report of diseases or anything else.

I shall endeavor to have this board do a little work if possible, this year, so that some kind of a report can be made.

WAUSEON, FULTON COUNTY.

Dr. J. H. Waddell, health officer.

Population (estimated), 2,500.

Streets, alleys and yards are in a cleanly condition. No complaint from

lack of sewerage. The board has successfully abated all nuisances. Night soil is removed by sanitary sewers. We have no garbage to speak of.

Contagious diseases are properly reported as far as I know. The records of such diseases are not kept. The board has been able to enforce proper restrictive measures. Measles has been the most prevalent contagious disease. The estimated number of persons vaccinated during the year is none. There are no unvaccinated children attending the public schools.

The board has held but one regular meeting during the year. There has been no money spent by the board of health. There have been no prosecutions brought by the board of health.

WAVERLY, PIKE COUNTY.

James J. Emmitt, health officer.

Population (estimated), 2,000.

The condition of the streets, alleys and yards is fairly good in warm weather. We have good sewerage. We have been unable to abate nuisances caused by hog pens. Night soil is removed in air-tight barrels. Garbage is buried.

Contagious diseases are properly reported with the exception of whooping cough. A record of such diseases is kept. Diphtheria has been more prevalent than usual. There are two hundred and thirteen unvaccinated pupils in the schools. The board held sixteen meetings and spent \$171.84.

Infectious diseases reported during the year: Diphtheria, 14 cases; scarlet fever, 2 cases; typhoid fever, 3 cases; whooping cough, 1 case.

WAYNESFIELD, AUGLAIZE COUNTY.

F. M. Berry, health officer.

Population (estimated), 600.

Streets, alleys and yards are kept in a cleanly condition. There is no complaint in regard to sewerage. No ar-

rangements for the disposal of night soil and garbage.

Contagious diseases have been reported and a record kept. Nearly all the school children were vaccinated last year.

No meetings were held by the board.

WAYNESVILLE, WARREN COUNTY.

Dr. H. Q. Alexander, health officer.

Population (estimated), 800.

Our little village is situated entirely on a hill-side, which gives us splendid surface drainage, the result being our streets, alleys and yards are for the most part in a good condition. Our sewerage system is on a miniature plan, but what we have does its work very well. Our greatest fault is our vault system, most of them are surface vaults which are not kept as clean as they should be. We have a garbage wagon during the warm weather, which hauls away all garbage to a place provided for that purpose.

Contagious diseases are not reported as they should be the fact of the matter is, we have not had control over them at all, owing to the opposition of the attending physician to the board of health or their neglect or unwillingness to report the same. Fortunately we have not been visited by any contagious diseases to any extent during my administration. As far as vaccination is concerned there has been very little, if any.

Our board of health meets the last Friday in every month, and oftener, if necessary. Expenses for last year, \$139.10. A careful investigation in regard to vaccination in the schools show 77 vaccinated and 82 not vaccinated, 63 out of the 77 are in the high school and in the room next to it, showing that there has been very little vaccination in the last few years.

WELLSTON, JACKSON COUNTY.

Thomas Wilson, health officer.

Population (estimated), 8,000.

Our city is in a very good sanitary condition at present. Our board has maintained an active organization and has been successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances. Our streets, alleys and yards are in a cleanly condition. We have no sewerage which is a great drawback to our town and is the main thing we need. There are no nuisances which the board has unsuccessfully tried to abate. Night soil is hauled in a tight tank about two miles away from town and buried. Garbage is hauled away also.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. Measles have been more prevalent than usual. There were no persons vaccinated during the year. There are 1,312 persons attending school unvaccinated.

Board of health held ten meetings during the year. Total amount spent by board of health for the year is \$42.00. There was one violation of the health laws brought before the board of health; a store keeper for keeping decayed fruits in the back yard. I removed 500 nuisances during the year.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 6 cases; scarlet fever, 4 cases; typhoid fever, 7 cases; measles, 500 cases.

WELLSVILLE, COLUMBIANA COUNTY.

Joseph T. Warren, health officer.

Population (estimated), 7,500.

Streets and alleys are not kept clean, particularly paved streets. Yards are kept in good condition. Have no sewerage. Night soil is hauled to the country on a farm. No arrangements made for garbage.

All contagious diseases are properly reported, excepting typhoid fever and it is difficult to get a proper report of it. A full record of such diseases is kept. Restrictive measures have been successfully enforced. The contagious diseases have been less in the past year than usual. Probably 100 vaccinated. 250 unvaccinated children attending school, Dec. 1st.

Eleven meetings have been held. Total amount spent during the year, \$650. Fined for the improper removing of night soil, four.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 1 case; scarlet fever, 7 cases; typhoid fever, 33 cases; measles, 12 cases; other infectious diseases, 20 cases.

WEST ALEXANDRIA, PREBLE COUNTY.

Dr. R. C. Hill, health officer.

Population (estimated), 1,000.

Sanitary condition of village good at present. We have no sewerage. Have no arrangements for disposing of night soil and garbage. We have a great deal of trouble in warm weather, as there is a county ditch running through village which is for the purpose of carrying surface water. There is a manhole on each side of the street to receive water from gutters. The stench was unbearable, and the only part of village we had typhoid fever. I found there were several sewers run into this county sewer, coming from hotel bath rooms and water closets, I cut them off and expect to have some trouble about it yet. This cutting sewer off relieved stench. These people claim the Council gave them a permit, but can show no papers and can find no such permit on record.

Contagious diseases, very few and no deaths reported. Physicians do not report as they should. Have been health officer six months and haven't had a birth report from any.

We have had four meetings in the last six months, expenses will not exceed \$50.00. No prosecutions (pretty good bluffer). Out of 169 pupils, 24 are vaccinated, 14 per cent.

WESTERN STAR, SUMMIT COUNTY.

P. A. Johnson, health officer.

Population (estimated), 103.

No report.

Infectious diseases reported during the year: Scarlet fever, 7 cases; whooping cough, 14 cases.

WESTERVILLE, FRANKLIN COUNTY.

James D. Budd, health officer.

Population (estimated), 1,800.

The number of meetings held during the year twelve.

All contagious diseases reported. Town in good condition. Streets and alleys clean.

Infectious diseases reported during the year: Scarlet fever, 2 cases; measles, 4 cases.

WEST JEFFERSON, MADISON COUNTY.

Wm. R. Borland, health officer.

Population (estimated), 1,500.

Streets, alleys and yards are in good condition. No complaint from sewerage. No nuisance which we did not successfully abate. Vaults for night soil.

Contagious diseases are properly reported and record kept. Fifteen children going to school not vaccinated.

Fifteen meetings of the board held. One hundred and forty-one dollars and nineteen cents expended.

Infectious diseases reported during the year: Typhoid fever, 3 cases; smallpox, 5 cases; whooping cough, 15 cases.

WEST LEIPSIC, PUTNAM COUNTY.

M. L. Pritchard, health officer.
Population (estimated), 550.

Sewerage is good. Streets, alleys and yards are in a cleanly condition. There is a dumping ground leased for the disposal of night soil.

Nine meetings of the board of health in the year. No money spent on contagious diseases. No prosecutions in last year.

Infectious diseases reported during the year: Scarlet fever, 1 case.

WEST LIBERTY LOGAN COUNTY.

Dr. R. M. Fulwider, health officer.
Population (estimated), 1,500.

Streets and alleys in good shape. We have no sewerage system. Night soil is removed by vault cleaners regularly licensed.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce restrictive measures. Scarlet fever has been more prevalent than usual. Do not know the number vaccinated. Very few children but that have been vaccinated.

The board has held five meetings. Total amount spent, \$90.00. No prosecutions were brought.

A ditch from low ground above the village which runs through the town is the cause of a nuisance which the board has been unable to abate.

Infectious diseases reported during the year: Scarlet fever, 24 cases; typhoid fever, 2 cases.

WEST MANCHESTER, PREBLE COUNTY.

Lewis Osterhaus, health officer.
Population (estimated), 400.

Our village has been very free from contagious diseases this last year. The town has been kept pretty well cleaned up and I believe that has prevented much sickness. The board of health

require all rubbish and trash to be gathered on piles and in boxes and barrels, convenient to be hauled out, and it is removed by health officer. There has been less sickness in this village by half, the last eight years than there was the previous eight years, when no attention was given the matter. The nuisances have all been abated so far as tried. The town council have a little trouble with R. R. Co. just now, with a drain, but I believe it will all be adjusted in reasonable time.

Infectious diseases reported during the year: Typhoid fever, 1 case; other infectious diseases, 1 case.

WEST MILTON, MIAMI COUNTY.

Dr. Gainor Jennings, health officer.
Population (estimated), 1,000.

There is room for improvement in the present sanitary condition of our village. The Milton board of health has maintained an active organization, and has been successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances. The streets, alleys and yards are in as cleanly condition as could be expected without systematic arrangements for the removal and disposition of garbage. Night soil is taken, at least twice a year, across the river east of Milton and deposited on the Sleppy farm. With one exception all the village physicians properly report contagious diseases. A record of contagious diseases is kept. During the past year there has been no epidemic of any contagious disease, notwithstanding the fact that scarlet fever has prevailed all around our village during the year.

There were only seven meetings of the Milton board of health held during the year. There were only six deaths in the village during the year. There were two cases of typhoid fever, and one case of scarlet fever. There were 284 nuisances abated during the year.

During the year here were no prosecutions brought by the Milton board of

health for violations of its orders or of health laws.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 2 cases.

WILLIAMSPORT, PICKAWAY COUNTY.

Dr. G. C. Hays, health officer.

Population (estimated), 600.

Sanitary conditions of our village is good. Our streets, alleys and yards are in good condition. Our sewerage is fine with good discharge for same. No unabated nuisances. We have a dumping ground and bury and burn our night soil and garbage.

All contagious diseases are reported immediately and a record kept by the secretary. Quarantine kept strictly in accordance with state law. We have had no contagious diseases during the year, no persons have been vaccinated.

About 50 per cent of the school children have been vaccinated.

The board of health has met eight or nine times during the year and expended \$50.00. We have had no prosecutions. We are treated kindly by all our people and have no trouble.

WILLOUGHBY, LAKE COUNTY.

Geo. B. Durban, health officer.

Population (estimated), 2,100.

No report.

WILMINGTON, CLINTON COUNTY.

Dr. A. T. Quinn, health officer.

Population (estimated), 4,000.

Streets, alleys and yards are kept in good condition. Sewerage good, all nuisances are abated without trouble. Night soil and garbage are removed from the corporation and spread out over farm lands.

Contagious diseases are properly reported when we have any but we have

been fortunate in the past year. I am unable to give the number of children vaccinated during the past year or the number not vaccinated. We have at least one meeting a month of the board of health and oftener if necessary. I am unable to give the amount spent by the board of health as the town council pays all the bills. We have a very healthy village. Scarcely ever any contagious diseases. We strictly enforce our sanitary regulations which accounts for our good health.

WINDHAM, PORTAGE COUNTY.

H. J. Higley, health officer.

Population (estimated), 300.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. Garbage and night soil are buried.

Contagious diseases are properly reported and a record kept. The board has been able to enforce proper restrictive measures. Very few of the school children have been vaccinated.

The board has held twelve meetings.

Infectious diseases reported during the year: Scarlet fever, 3 cases.

WINTON PLACE, HAMILTON COUNTY.

Geo. C. Wildman, health officer.

Population (estimated), 1,200.

Winton Place is in fair sanitary condition considering the fact that it has no sewerage. The health board has advocated sewers for some time and on Feb. 6th, there will be an election for the purpose of issuing \$55,000 in bonds for complete sewerage.

Contagious diseases are reported properly and a record kept of them. There are a number of unvaccinated children attending school. The per cent of those not vaccinated is very small.

The board of health meets the first Tuesday of each month. \$120 was ex-

pended by the board of health in the past year. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 1 case; measles, 1 case.

WOODSFIELD, MONROE COUNTY.

A. S. Baker, health officer.

Population (estimated), 1234.

Streets in good condition, alleys in fair condition. There is cause for complaint from lack of sewerage. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage hauled beyond or buried in town limits.

Contagious diseases were properly reported, with some exceptions, of which record is kept. Board has been able to enforce proper restrictive measures. Scarlet fever has been more prevalent than usual.

Board of health held four meetings during year. Board has spent sixty dollars during year. There were no prosecutions brought for violations of orders or health laws.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 2 cases; scarlet fever, 18 cases; typhoid fever, 4 cases.

WOODSTOCK, CHAMPAIGN COUNTY.

D. P. Smith, health officer.

Population (estimated), 400.

Streets are in good condition, sewerage good. No nuisances. They haul off night soil and garbage.

Contagious diseases are properly reported. The board handles all cases of contagious diseases. No vaccinations.

The board held only three meetings. No money spent by the board of health.

Infectious diseases reported during the year: Typhoid fever, 4 cases.

WYOMING, HAMILTON COUNTY.

Geo. Stoddard, health officer.

Population (estimated), 2,000.

Sanitary condition of the town is good. Streets and alleys kept clean and twenty-three vaults cleaned under permits of health officer and overlooked by sanitary police.

Rules of State Board of Health followed as far as possible in contagious diseases. Our whole town was vaccinated a little over a year ago when we had the small-pox.

Board of health held four meetings. Expenses were about \$110.

Infectious diseases reported during the year: Typhoid fever, 1 case; measles, 5 cases.

XENIA, GREENE COUNTY.

Dr. A. D. DeHaven, health officer.

Population (estimated), 10,000.

Our streets and alleys are in a very filthy condition and we have plenty of cause for complaint from lack of sewerage. No arrangements for the disposal of garbage has been made.

Contagious diseases are (as a rule) promptly reported and a full record of such diseases kept. Scarletina has been most prevalent of any contagious disease and the hardest to abate.

The board has had eighteen meetings last year, and the amount of money spent by board was \$767.49.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 19 cases; small-pox, 4 cases.

YOUNGSTOWN, MAHONING COUNTY.

Dr. H. E. Welch, health officer.

Population (estimated), 60,000.

No report.

Infectious diseases reported during the year: Diphtheria, 71 cases; scarlet fever, 38 cases; typhoid fever, 352 cases; small-pox, 1 case; whooping cough, 26 cases; measles, 18 cases.

ZANESVILLE, MUSKINGUM
COUNTY.

Dr. H. T. Sutton, health officer.

Population (estimated), 21,000.

We consider that our streets, alleys and yards are in a very good sanitary condition. We need and are advocating more sewers and the city is building them as fast as their finances will permit. The discharge of sewage is satisfactory. There have been no nuisances which the board has been unable to abate satisfactorily. Night soil is disposed of in trenches outside of the city, according to law.

During the summer months we employ teams and garbage carts to haul the garbage out into the country where it is fed to hogs.

Contagious diseases are properly reported and a record of the same is filed. We believe that we have been successful in enforcing proper restrictive measures. We have been very free from contagious diseases in the past year, with the exception of a mild form of scarlet fever. Vaccination last year was very general on account of small-pox scare, and all children attending public, parochial and private schools were required to be vaccinated. The health officer, vaccinated about three hundred poor children.

Board of health held six meetings during the year and the total expenses of the board last year were \$1,800.00. One man was arrested for committing a nuisance and fined. One physician was arrested for not reporting a contagious disease. He satisfied the Mayor that it was not intentional and was not fined.

Infectious diseases reported during the year: Membranous croup, 3 cases; scarlet fever, 32 cases; typhoid fever, 68 cases; small-pox, 1 case.

ZOAR, TUSCARAWAS COUNTY.

Chas. F. Sylvan, health officer.

Population (estimated), 300.

Streets, alleys and yards in cleanly condition. No cause of complaint from lack of sewerage or improper discharge of same. There were no nuisances which it was necessary to abate to this date.

Had no contagious diseases of any kind. None vaccinated.

The board of health held one meeting. No expenditures were necessary. No prosecutions were brought by the board of health for violations of orders or health laws.

ANNUAL REPORTS OF TOWNSHIP BOARDS OF HEALTH.

The following list of questions was sent to each township board of health:

1. How many meetings has the board held during the year?
2. Give number and character of nuisances abated by the board?
3. How many cases of contagious diseases were quarantined by the board?
4. Have attending physicians failed to report contagious diseases?
5. Has the board brought any prosecutions during the year?
6. If so, for what cause and with what result?
7. Give estimated number of persons in the township who were vaccinated during the year?
8. What amount of money was spent for board of health purposes?
9. What suggestions have you to offer for increasing the efficiency of township boards of health?

The replies, as well as the lack of replies, indicate that sanitary matters are still much neglected in the many rural districts. This is not true of all, for in some of the townships most excellent work is being done by the board of health.

The law creating boards of health in the townships, enacted in 1893, is as follows:

"In each township the trustees of the township shall constitute a board of health, which shall be for the township outside the limits of any city or village, and such boards shall have the same duties and powers as are herein imposed upon or granted to boards of health in cities and villages. They shall annually elect one of their number president, and the township clerk shall be the clerk of the board of health; they may appoint a health officer and as many sanitary officers as they deem necessary to carry out the provisions of this act, and define their duties and fix their compensation; and such appointees shall serve during the pleasure of the board. Township boards of health shall meet annually and at such other times only as is actually necessary. (O. L. Vol. 91, p. 23.)

There are 1,357 townships in Ohio, and consequently that many boards of health; for the trustees under this law constitute a board of health in each township, whether they meet to organize or not.

Taking up the answers to the questions given above, there were 875 boards, or 64.5 per cent. of the total number that sent in replies.

Question 1 Number of meetings held.

Five hundred and seventy boards held meetings during the year, thirty-eight of which held no special board of health meetings, but transacted such business at the regular township trustee meetings.

Question 2. Nuisances abated.

There were 477 nuisances abated by 131 different township boards.

Question 3. Contagious diseases quarantined.

Contagious diseases are reported in 408 of the 875 townships reporting. One hundred and twenty reported that they had been entirely free from contagious diseases. The total number of contagious diseases quarantined in the 408 townships reporting such diseases was 2,196. In 123 townships all or part of the physicians failed to report.

Question 5. Prosecutions.

Seven boards brought ten prosecutions for violation of the health laws. Of these suits nine were won and one was pending at the time of the report.

Question 7. Vaccination.

In 168 townships there were reports of vaccination having been performed. The number of persons estimated to have been vaccinated in the 168 townships was 10,038.

Question 8. Expenses.

In but 337 of the 875 townships reporting was any money spent for board of health purposes. The aggregate amount was \$18,423.29. This is an average of about \$45.76 for each township.

These reports are somewhat discouraging. There are several causes for the neglect or failure of township boards of health to properly perform their duties. First, such boards are composed of men who have paid but little attention to sanitary matters. The membership of these boards is subject to too frequent changes. The members are generally unwilling to pay a sufficient sum to secure the services of a person for health officer, properly qualified to advise and assist them, and to carry out their orders. While we could wish for a greatly better showing for our rural boards of health, we should not lose sight of the fact that six years ago there was practically no protection against communicable diseases or injurious nuisances in rural districts, and no boards of health for the enforcement of health laws outside of cities and villages.

ABSTRACT OF REPORTS

OF

DEATHS AND THEIR CAUSES

IN THE FOLLOWING

CITIES, TOWNS AND TOWNSHIPS IN OHIO

FOR THE

For the Year Ending December 31, 1899.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF JANUARY, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Alliance	11,578	8	8.09	1	2	2													1		3		2	3												
Bellaire	12,036	17	16.95	2	6	1				1	1										4		2	12												
Bucyrus	8,902	5	6.74																		1		1	2												
Circleville	7,524	13	20.73	1																	3		1	10												
Defiance	9,759	3	3.69																		1		1	2												
Delaware	9,639	11	13.59	1	1	1															1		1	10												
Fostoria	13,079	5	4.59	3																	1		1	4												
Fremont	6,132	11	21.53	1	2																5		5	4												
Gallatin	7,019	12	20.37	1	1	1															3		2	8												
Gallipolis	4,553	16	42.19																		2		1	5												
Greenville	8,167	6	8.57																		2		1	3												
Kenton	7,598	4	6.32																		1		1	4												
Lancaster	8,302	4	5.78																		1		1	3												
Marietta	12,084	25	24.82	2	3	1															4		1	13												
*Marion	16,484	12	8.74		1	1															2		3	9												
*Martin's Ferry																					1		1	8												
Middletown	12,334	12	11.68	2	2	2			2												1		1	1												
*Mt. Vernon	8,567	6	8.12		1	1															1		1	2												
Norwalk	13,148	9	8.21	2																	2		1	2												
*Piqua																					1		1	1												
*Pomeroy						2															3		1	7												
Salem	7,976	12	18.05																		1		1	4												
Troy	5,222	4	9.19																		1		1	1												
Urbana	6,750	8	14.22	1																	2		1	5												
Warren	8,573	14	19.58																		1		1	8												
Washington C. H.	8,339	6	8.63	1	1	1															1		1	4												
Wellington	8,000	9	13.40	3																	1		1	3												
Wellsville	7,800	9	13.55	1	4	1															3		1	2												
Wellsboro	5,956	20	40.29	2	2																3		2	10												
Wooster	7,557	12	19.05	2	5																1		1	5												
Xenia																					1		1	1												
Totals	243,683	273	13.44	23	19	27	2	....	4	1	1	1	1	1	1	2	1	4	4	53	9	29	164	11	11	8	1	6	39	14	1	34	13	6	9	

* No report received.

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF MARCH, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhœal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Akron	30,667	26	10.17	6	3	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	1	16	1	1	...	...	1	3	1	...	7	4	1
Canton	11,612	13	13.43	3	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	6	2	1	15	2	...	...	...	1	1	...	1	1	1	
Chillicothe	325,902	578	21.28	83	72	72	7	...	1	...	...	...	...	...	...	...	...	...	...	...	129	22	73	304	14	4	32	10	9	32	27	61	40	32	51
Cincinnati	381,768	497	15.62	99	67	61	8	1	5	1	...	...	...	...	...	...	...	...	...	...	81	18	18	271	12	8	18	37	15	27	20	83	63	17	30
Cleveland	125,160	136	13.04	15	4	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	35	9	24	68	6	5	2	4	2	15	13	12	16	5	10
Columbus	85,333	115	16.17	...	4	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	31	1	23	62	3	1	1	4	1	3	4	9	13	5	9
Dayton .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*East Liverpool	20,000	23	13.80	4	1	3	...	...	3	...	...	...	...	...	...	...	...	...	...	...	4	...	4	15	1	...	...	...	1	1	...	5	1	1	1
Findlay	24,523	25	12.23	7	3	8	1	...	7	...	...	...	...	...	...	...	...	...	...	...	7	...	3	8	1	...	...	...	1	2	...	2	1	1	1
Hamilton	13,229	17	15.42	3	3	3	...	...	1	...	...	...	...	...	...	...	...	...	...	...	2	...	1	13	...	...	...	...	1	1	...	3	5	...	...
Lima	31,314	31	11.88	3	4	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	1	3	15	...	...	...	...	...	1	7	3	6	4	...
Mansfield	17,845	18	12.10	4	...	3	1	...	10	10	2	1	1	...	3	2	1	2
Massillon	14,323	10	8.37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	2	13	...	...	...	...	1	1	...	3	1	1	1
Newark	20,386	21	12.35	2	3	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	6	...	...	...	...	1	1	...	2	...	2	2
Portsmouth	13,346	21	16.18	2	...	2	1	...	1	2	2	1	...	3	1	6	3	3
Sandusky	21,211	22	12.44	4	1	3	15	3	12	29	9	2	6	3
Springfield	47,002	62	15.83	8	7	13
Steubenville
Tiffin	14,345	7	5.85	2	5
Toledo	131,822	143	13.02	27	18	28	10	...	...	...	...	...	...	...	...	...	...	...	...	...	26	8	14	65	...	...	...	...	5	6	...	24	19	5	22
Youngstown	66,217	78	14.13	17	6	6	6	1	4	59	4	3	1	6	...	6	14	5	21
Zanesville
Totals	1,336,010	1,840	15.82	287	107	225	28	2	35	1	2	116	3	8	43	7	358	67	185	981	58	25	71	72	42	108	95	3	240	185	80	151

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF MARCH, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Scarlet fever.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.*	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Alliance	11,878	9	9.00		1	2	1									1	1	4	1	3		2					1	1		1		3		
Bellaire	12,036	15	14.95	4	1	4												2	1	1		2					1	1		1		1		
Bucyrus	8,902	3	4.04																														1	
Circleville	7,524	13	20.73	3		1												3	1	1		1					1	1		1		1		
Defiance	9,759	5	6.15			2																											1	
Delaware	9,039	10	12.40	1																													1	
Fostoria	13,079	10	9.18		1	1																											1	
Fremont	6,132	6	11.74																														1	
Gallion	7,019	11	18.80			1																											1	
Gallopis	4,658	11	28.96		1																												1	
Greenville	8,167	7	10.28																														1	
Kenton	7,598	6	9.48			1																											1	
Lancaster	8,302	12	17.34	1		2																											1	
Marietta	12,084	10	9.93	1	1	2																											1	
*Marion's Ferry																																	1	
Middletown	12,334	10	9.73	1																													1	
Mt. Vernon	6,825	10	17.58	1	2																												1	
Norwalk	8,867	7	9.46			2		1	1																								1	
Piqua	13,148	10	9.13	3	2	2																											1	
*Pomeroy																																	1	
Salem	7,970	9	13.54	3	1																												1	
Troy	5,222	13	31.80			3																											1	
Urbana	6,750	5	8.88						1																								1	
Washington C. H.	8,573	4	5.60																														1	
Wellston	8,333	9	13.00	2	1																												1	
Wellsville	7,900	19	25.50	2	7	11																											1	
Wesleyville	7,900	18	27.70	5	1	8			2																								1	
Wessex	7,559	11	22.16																														1	
Xenia	7,559	9	14.30	1		1																											1	
Totals	234,024	202	13.44	29	10	46	1	2	4	1	4	3	8	1		5	1	56	7	38	129	19	8		4	5	10	28	7	25	14		9	11

* No report received.

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF APRIL, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrheal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Akron	30,667	30	11.73	4	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	4	9	2	2	1	1	1	1	1	1	1	1	1	
Canton	11,612	22	22.70	2	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	4	5	1	2	2	2	1	1	1	1	1	1	1	
Chillicothe	325,902	591	21.76	96	76	83	3	10	3	3	3	3	16	2	1	1	1	1	1	1	1	18	70	325	8	8	3	35	11	12	33	26	67	42	3	1
Cincinnati	331,763	497	15.62	120	51	55	5	1	1	1	1	1	1	1	1	1	1	1	1	1	75	16	325	7	3	16	44	11	37	23	49	77	27	19	25	45
Cleveland	135,160	164	15.72	15	8	9	1	1	1	1	1	1	1	2	1	1	1	1	1	1	41	4	34	98	5	7	2	3	16	44	20	12	25	12	6	7
Columbus	135,160	164	15.72	15	8	9	1	1	1	1	1	1	1	2	1	1	1	1	1	1	25	2	17	47	6	1	1	5	1	8	1	8	1	8	1	6
Dayton	85,333	108	15.19	17	17	17	1	7	7	3	3	3	1	1	1	1	1	1	1	1	25	2	17	47	6	1	1	5	1	8	1	8	1	8	1	6
East Liverpool	20,000	15	9.00	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	3	4	6	1	1	1	1	1	1	1	1	1	1	2	
Findlay	21,523	24	11.74	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7	4	3	4	1	1	1	1	1	1	1	1	1	1	1	
Hamilton	13,229	20	18.14	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	1	3	4	1	1	1	1	1	1	1	1	1	1	1	
Ironton	31,314	35	13.41	6	5	10	1	1	1	1	1	1	1	2	1	1	1	1	1	1	9	4	4	3	6	1	1	1	1	1	1	1	1	1	1	3
Lima	17,845	13	8.74	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	4	2	6	7	6	1	1	1	1	1	1	1	1	1	1	2	
Mansfield	14,328	11	9.21	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	7	7	6	3	6	1	1	1	1	1	1	1	1	1	1	
Massillon	14,328	11	9.21	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	7	7	6	3	6	1	1	1	1	1	1	1	1	1	1	
Newark	20,386	14	8.24	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	7	7	6	3	6	1	1	1	1	1	1	1	1	1	3	
Portsmouth	13,346	21	18.88	7	1	8	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	3	11	5	1	1	1	1	1	1	1	1	1	1	3	
Sandusky	21,211	23	13.01	3	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	5	1	1	1	1	1	1	1	1	1	1	3	
Springfield	47,002	43	10.98	2	4	12	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	3	
Staubsville	14,345	5	4.18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	
Tiffin	14,345	5	4.18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7	
Toledo	131,822	173	15.75	99	22	98	6	2	4	1	1	1	1	1	1	1	1	1	2	1	37	8	20	81	5	2	3	8	2	11	3	18	24	1	23	
Youngstown	66,217	64	11.59	13	5	11	1	1	1	1	1	1	1	1	1	1	1	1	8	2	45	1	2	4	1	1	1	1	1	1	1	1	1	1	2	7
Zanesville	1,396,010	1,873	16.10	310	182	261	19	3	41	811	220	6	9	48	5	353	55	197	509	38	21	66	79	33	130	76	1	207	190	78	117	78	117	78	117	
Totals	1,396,010	1,873	16.10	310	182	261	19	3	41	811	220	6	9	48	5	353	55	197	509	38	21	66	79	33	130	76	1	207	190	78	117	78	117	78	117	

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF APRIL, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Alliance	11,878	6	6.06	...	1	1	1	...	1	3	...	1	1	1	16	...	1	...	2	1	3
Bellaire	12,086	23	22.93	5	4	6	1	...	...	...	...	...	...	...	...	...	...	...	1	1	1	13	...	...	1	...	...	...	1	...	...	...	...
Bucyrus	8,902	4	5.40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	...	...	...	...
Greenville	7,524	15	23.92	7	1	2	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	10	...	...	...	...	...	...	...	...	...	...	...
Defiance	9,759	5	6.15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Delaware	9,639	12	14.91	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Reston	13,079	5	4.59	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Fremont	6,132	10	19.57	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Gallion	7,019	7	11.97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Gallipolis	4,558	18	47.39	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Greenville	8,167	7	10.28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Kenton	7,593	5	7.59	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Lancaster	8,302	12	17.34	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Marion	12,034	12	11.92	2	1	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Marion's Ferry .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Midletown	12,334	9	8.76	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mt. Vernon	6,825	7	12.31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Norwalk	8,867	8	10.83	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Prucha	13,148	11	10.04	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pomeroy .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salmon	7,976	6	7.52	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Troy	5,222	13	31.80	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Urbana	6,750	7	12.46	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Warren	8,573	10	14.00	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Washington C. H.	8,339	7	10.07	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellston	7,000	15	22.50	2	6	2	...	...	...	...	...	...	...	...	...	...	...</						

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF MAY, 1899.

Cities of 10,000 inhabitants (census 1900 or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhœal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Akron	30,667	22	22.73	1	2	2																												
Canton	11,612	12	12.40	1																														
Chillicothe	825,902	549	20.21	108	74	93	7	3	20	2	5	9				13		109	16	67	290	17	6	15	6	18	41	57	32	30	27	49		
Cincinnati	381,768	426	13.39	100	35	33	3	6	6							10		64	18	12	231	11	9	9	28	9	85	28	39	65	26	33		
Cleveland	125,160	110	13.50	6	9	1													38	7	29	54	3	3	3	5	2	9	4	1	9	12	6	
Columbus	85,333	117	16.45	14	9	16		1	7										40	4	24	89	2	9	1	2	3	11	11	5		3	10	
* Dayton																																		
* East Liverpool																																		
Findlay	20,000	11	6.60	1	1	2													4	1	2	5	1	2										
Hamilton	24,523	25	12.24	1	1	7													10	3	10	4	2											
Ironton	13,229	11	9.97	1															2	4	1	11	3	1										
Lima	31,314	33	12.64	8		4													6	1	1	4	1	1										
Lima	17,845	14	9.41		4	1													4	1	1	10	1	1										
Massillon	14,328	17	14.23																13	3	1	1	2											
Massillon	20,886	12	7.06	1		3													1	1	1	1	1											
Newark	13,346	11	9.87	1		2													1	1	1	1	1											
Perkinsmouth	21,211	22	12.44	1	1	1													1	1	1	1	1											
Sandusky	47,002	43	10.98	4	3	8			6										9	1	3	2	3											
* Springfield																																		
* Steubenville																																		
Tiffin	14,345	8	6.69	1		1													2	1	1	1	1											
Toledo	131,822	121	11.01	20	15	25	7	3	5	1									13	5	1	1	1											
Youngstown	66,217	43	7.79	8	4	7													4	4	1	2	24	1										
* Zanesville																																		
Totals	1,396,010	1,607	13.81	277	158	208	17	9	53	3	6	10	1	7		41	3	322	57	177	814	43	40	34	46	41	134	113	3	110	164	93	148	

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF MAY, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrheal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF JUNE, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Akron	30,667	23	8.98	4	1	5	2	1	1	1	1	1	1	1	1	1	1	1	1	6	1	2	7	2	1	1	1	2	1	1	1	1	1	4	1	1
Canton	11,612	17	17.57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Chillicothe	325,902	444	16.35	104	39	79	4	12	10	5	2	3	16	8	17	6	32	24	1	8	22	43	292	7	6	8	17	32	1	6	37	21	18	37	21	49
Cincinnati	381,768	390	12.26	97	34	53	3	12	5	1	1	1	2	1	2	10	4	16	175	59	14	16	178	7	4	5	30	19	97	22	25	37	35	21	35	
Cleveland	135,160	98	9.39	4	6	8	...	...	...	...	...	...	...	...	...	...	...	...	...	21	4	17	58	5	7	2	1	5	15	7	1	8	4	7	6
Columbus	185,333	93	13.08	12	7	13	...	3	6	1	1	1	1	1	1	1	1	1	1	33	6	16	38	4	5	...	1	1	10	4	...	2	4	10		
Dayton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
East Liverpool	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Findlay	20,000	17	10.20	3	1	2	1	...	...	...	...	...	...	...	...	...	...	...	1	4	...	3	8	1	1	...	1	...	...	...	...	...	...	...	...
Hamilton	24,523	20	9.79	8	1	2	...	2	...	...	...	...	...	...	...	...	...	...	...	9	1	3	5	...	...	...	...	...	...	...	...	...	...	...	...
Ironton	13,229	11	9.98	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	13	6	...	...	...	...	...	...	...	...	...	...	...	...
Lima	31,314	21	8.04	2	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mansfield	17,845	13	8.74	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Massillon	14,328	5	4.15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Newark	20,336	11	6.47	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Portsmouth	13,346	13	11.69	2	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sandusky	21,211	15	8.96	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Springfield	47,002	35	8.93	2	...	4	...	1	...	...	...	...	...	...	...	...	...	...	2	9	4	5	17	1	2	1	1	1	3	5	1	1	2	3	8
Steubenville
Tiffin	14,345	12	10.04	2	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Toledo	131,822	109	9.92	21	10	17	3	4	1	2	1	1	4	2	3	13	41	2	8	29	8	13	41	2	3	...	2	...	...	...	...	...	...	...
Youngstown	66,217	43	8.15	8	4	5	...	1	...	...	...	...	...	...	...	...	...	...	...	7	2	5	24	1	...	1	1	4	3	...	...	...	...	...	...
Zanesville	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals	1,396,010	1,392	11.26	265	110	195	14	35	24	...	10	5	...	8	1	3	...	37	7	300	67	142	655	34	30	17	61	42	121	72	2	64	115	99	134	

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF JUNE, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population estimated.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Alliance	11,878	11	11.11	2	2	1			1												1		1	5			1		3	1			10	
Bellare	12,036	8	7.88																		4		3	1			1						10	
Bucyrus	8,902	4	5.40																		1		1	4					1				1	
Circleville	7,524	4	6.10	1																	2		1	2					1				1	
Defiance	9,759	6	7.38			3															2		2	1									1	
Delaware	9,689	6	7.46																		3		1	5					2				1	
Festonia	13,079	7	6.42	1																	3		1	5									1	
Fremont																					2		1	1										
Gallion	7,019	1	1.70																		1			1										
Gallipolis	4,558	6	15.80																		3		1	3					2				1	
Greenville	8,167	4	5.88						1												1		1	3					1				1	
Kenton	7,598	3	4.71																		2		1	5					1				1	
Lancaster	8,302	9	13.01	2																	2		1	7					1				1	
Marietta	12,084	11	10.92	3		1		1													2		2	7					2				1	
Marion																					1		1	2					1				1	
Martin's Ferry	9,736	7	8.63	2		1															2		1	1					1				1	
Middletown	12,334	5	4.86	1																	2		1	1					1				1	
Mt. Vernon	6,825	7	12.31	1		1															2		1	1					1				1	
Norwalk	8,867	5	6.77																		1		1	1					1				1	
Piqua	13,148	11	10.04	2		1		1													2		1	7					3				1	
Pomeroy																					1		1	1					1				1	
Salem	7,976	6	9.03	2																	1		1	2					1				1	
Troy	5,222	9	20.07																		1		1	1					1				1	
Urbana	6,750	3	5.33																		2		1	3					1				1	
Warren	8,573	6	8.40																		2		1	3					1				3	
Washington C. H.	8,339	7	10.08	2	4			1	2												4		2	3					1				1	
Wellston	8,000	10	15.00	2	1																1		1	2					1				1	
Wellsville	7,800	7	10.77	1		3															1		1	4					1				1	
Wooster	5,956	7	14.10			1															1		1	1					1				1	
Xenia	7,557	7	11.12			2															1		1	1					1				1	
Totals	237,628	177	8.94	15	12	23	3	5	1	1	1	1	1	1	1	1	1	3		45	16	25	80	7	8	2	5	5	29	7	6	13	12	11

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF JULY, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population estimated.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
* Akron	30,667	31	12.13	13	1	4		3																											
Canton	11,612	28	23.11	3	3	11		5											2	1	7														
Chillicothe	825,902	444	16.16	98	49	62	5	16	3	5	1	2	1	1	1	1	1	1	2	4	96	14	53	10	7	12	4	9	31	22	10	38	44	42	
Cincinnati	581,768	518	16.28	197	55	123	3	61	1	5	3	3	1	3	1	1	1	7	5	95	16	9	204	5	6	5	37	15	31	32	17	92	33	36	
Cleveland	125,160	140	13.42	29	15	43		30		3								3	1	29	10	17	37	4	3		1	6	9	4	1	16	15	11	
Columbus	85,533	105	14.76	22	4	30		5	3		1	1	1	1	1	5	5	5		25	5	17	36	3	6		4	3	10	2	1	2	9	5	
* Dayton	20,060	19	11.40	5	1	6		2																											
East Liverpool	24,323	34	16.64	8	3	10	1	1	5	2	1								1	2	2	10	1	1											
Findlay	13,229	17	13.42	1		2																													
Hamilton	31,314	26	9.96	9	4	9		3											1	6	4	4	3	12	4	1	2	1	1	1	1	1	3	2	
Lima	17,845	16	10.75	1	3	5	1	1												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mansfield	14,328	9	7.34																	2	5	1	2	5	1	1	1	1	1	1	1	1	1	1	
Massillon	20,386	16	9.41	4	2	2		2												2	2	4	5	1	1	1	1	1	1	1	1	1	1	1	
Newark	13,346	18	16.19	7	1	6		4	1											6	6	4	5	1	1	1	1	1	1	1	1	1	1	1	
Portsmouth	21,211	29	16.40	5	5	4		4												6	6	4	5	1	1	1	1	1	1	1	1	1	1	1	
Sandusky	47,062	37	9.45	8	1	6		4	1	1	1									6	6	4	5	1	1	1	1	1	1	1	1	1	1	1	
Springfield	14,345	7	5.84	1																															
Stuebenville	131,822	138	14.30	60	18	67	8	32	1	12	3	1	1	1	1	1	1	1	2	1	19	6	7	49	2	1	1	5	3	5	1	3	18	4	19
Tiffin	66,217	63	11.42	29	5	27		10			3								2	2	7	1	6	23		4	3	1	1	1	2				
Toledo																																			
Youngstown																																			
* Zanesville																																			
Totals	1,396,010	1,715	14.74	500	170	419	18	180	14	11	25	31	1	3	3	3	3	34	10	296	58	141	609	32	30	22	61	52	112	75	1	32	198	123	136

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF JULY, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Eruptive fever.	Scarlet fever.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Alliance	11,878	4	4.05	3	...	...	...	...	1	1	...	...	...	...	...	...	...	...	3	1	1	2	...	...	...	...	1	1	...	...	...	...	...
Bellevue	12,086	10	9.97	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	1	6	...	...	...	...	1	1	...	...	...	...	...
Bucyrus	8,902	3	4.04	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Circleville	7,524	7	11.16	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Defiance	9,759	3	3.69	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Delaware	9,639	8	9.94	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fostoria	13,079	2	1.84	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*Fremont .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Galion	7,019	2	3.40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gallipolis	4,558	16	42.12	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	1	1	6	...	...	...	...	1	3	...	...	...	...
Greenville	8,107	2	2.94	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	1	4	...	...	...	...	1	1	...	...	...	...
Kenton	7,598	10	15.78	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	1	6	...	...	...	...	1	1	...	...	...	...
Lancaster	8,302	7	10.12	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	1	6	...	...	...	...	1	1	...	...	...	...
Marion	12,084	12	11.92	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	6	...	...	...	...	1	1	...	...	...	...
*Martins Ferry	9,736	8	9.86	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	5	...	...	...	...	1	1	...	...	...	...
Middletown	12,334	10	9.72	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...
Mt. Vernon	6,825	6	10.54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	5	...	...	...	...	1	1	...	...	...	...
Norwalk	8,897	4	5.44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	1	5	...	...	...	...	...	...	...	...	...	...
Piqua	13,148	11	10.04	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	...	...	...	...	...	...	...
*Pomeroy .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salem	7,976	7	10.53	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	2	1	5	...	...	...	...	...	...	...	...	...	...
Troy	5,222	2	4.59	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	3	...	...	...	...	1	1	...	...	...	...
Urbana	6,750	9	16.00	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...
Warren	8,573	6	8.40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	3	...	...	...	...	...	...	...	...	...	...
Washington C. H.	8,339	7	10.08	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	4	...	...	...	...	...	...	...	...	...	...
Wellston	8,000	10	15.00	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	4	...	...	...	...	...	...	...	...	...	...
Wellsville	7,800	9	13.85	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	4	...	...	...	...	...	...	...	...	...	...
*Wooster .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Xenia	7,557	17	26.99	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals	231,672	192	9.95	23	6	36	1	13	1	1	...	4	1	1	...	1	2	...	3	8	51	8	30	86	5	...	...	1	2	...	...	...	...

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF AUGUST, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population estimated.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Akron	30,667	34	13.30	7	1	6		2	1											12	1	5	9	1	1				1			1	7		
Canton	11,612	19	19.64	4	1	3														76	21	40	176	8	5		4	10	34	14			8	32	
Chillicothe	325,902	384	14.14	64	38	71	6	8	1	5	7	6								11	70	21	40	176	8	5	7	5	10	34	14		8	39	
Cincinnati	381,768	451	14.17	141	51	84	4	40	2	2	1	4								11	77	20	21	162	12	9	10	13	13	19	11		17	83	22
Cleveland	125,160	155	14.86	44	10	46		17		1	6	1								5	37	11	24	56	5	4	1	3	3	9	7		2	10	4
Columbus	85,333	86	12.09	12	6	22		4	4	3	4	1								14	4	9	34	6	3	1	3	1	6	2	1	3	10	6	12
Dayton																																			
East Liverpool																																			
Findlay	20,000	28	16.80	5	4	7		4												3	15	1		1				1	1	1		2	1	3	
Hamilton	24,523	26	12.72	7	1	5		1	3											12	3	6						1	1	1		1	1	3	
London	13,229	19	17.23	5	3	5														4	1	1						1	1	1		4	1	1	
Lima	31,314	32	12.26	5	6	15		2												4	1	1						1	1	1		1	1	2	
Mansfield	17,845	21	14.12	3	2	10														1	1	1						1	1	1		1	1	1	
Massillon	14,328	11	9.21																	1	1	1						1	1	1		1	1	1	
Newark	20,386	23	13.53	3	5	6	1	2	1	1										3	2	1	6	5	1		1	1	1	2		1	1	1	
Portsmouth	13,346	13	11.69	3	3	4	2													3	1	1						1	1	1		1	1	1	
Sandusky	21,211	18	10.18	4		3		1												3	1	1	22	3	1		1	5	3	2		3	3	4	
Springfield	47,062	43	10.98	10	5	12		4												3	1	1					1	5	3	2		3	3	4	
Steubenville																																			
Tiffin	11,345	12	10.04	2	3																												1	1	1
Toledo	131,822	176	16.02	48	22	63	13	19												1	6	16	47	1	4	2	5	3	5	6		5	21	3	3
Youngstown	66,217	60	10.87	22	13	21		18												28	6	4	22	4	1	1	6	1	6	5		2	8	3	3
Zanesville																				4															
Totals	1,396,010	1,611	13.85	392	171	391	26	126	15	132	35	1	1		6	2	56	8	295	71	136	647	39	33	23	51	41	100	47	1	40	188	103	139	

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF AUGUST, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Scarlet fever.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Alliance	11,878	12	12.12	4	3	3	3	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bellaire	12,036	9	8.97	1	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bucyrus	8,902	7	9.44	...	...	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Circleville	7,524	4	6.40	1	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Defiance	9,750	3	3.69	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Delaware	9,639	13	16.18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fostoria	13,079	12	14.92	4	...	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* Fremont .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* Galion	4,558	12	31.60	...	...	6	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Galipolis	5,588	12	5.88	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Greenville	8,167	10	15.78	...	...	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kenton	7,968	13	18.79	1	1	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lancaster	8,302	13	18.79	1	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Marion	12,054	7	6.95	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* Marion	9,736	11	13.58	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Martin's Ferry	12,334	8	7.78	2	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Middletown	6,825	7	12.31	1	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mt. Vernon	8,807	5	6.77	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Norwalk	13,148	11	10.04	4	1	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Piqua	7,976	9	13.51	1	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* Pomeroy	5,222	9	20.07	1	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salem	6,750	5	8.88	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Troy	8,573	10	14.00	2	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Urbana	8,339	9	13.00	3	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Washington C. H.	8,000	9	13.50	3	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellston	7,800	6	9.27	2	...	3	...	...	...	...	...	...	...	...	...	...	...	...			

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF SEPTEMBER, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population estimated.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Fuercial fever.	Scarlet fever.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Akron	30,667	26	10.17	2	2	5	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Canton	11,612	15	15.50	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Chillicothe	374	13.92	48	39	46	9	7	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Cincinnati	325,962	409	12.85	107	43	23	16	20	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Cleveland	351,768	469	13.35	107	43	23	16	20	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Columbus	125,160	129	12.37	14	12	10	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Dayton	85,333	93	13.36	23	12	10	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
East Liverpool	20,000	21	14.40	10	2	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Findlay	24,523	17	8.32	5	1	3	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hamilton	13,229	12	10.88	1	2	13	1	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Ironton	31,314	35	13.41	5	3	13	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Lima	17,845	21	16.13	3	3	9	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mansfield	14,328	9	7.64	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Massillon	20,386	10	5.88	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Newark	13,346	13	11.69	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Portsmouth	21,211	17	9.61	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Sandusky	47,002	43	10.95	15	14	14	4	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Springfield	14,345	15	12.54	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Steuenville	131,822	169	14.32	44	21	62	21	12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Tiffin	66,217	34	7.07	17	1	14	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Toledo	131,822	169	14.32	44	21	62	21	12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Youngstown	66,217	34	7.07	17	1	14	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Zanesville	1,396,010	1,470	12.64	324	135	303	56	65	16	4	24	14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Totals	1,396,010	1,470	12.64	324	135	303	56	65	16	4	24	14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF OCTOBER, 1899.

Cities of 10,000 inhabitants census 1900 or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhœal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
*Akron	30,667	19	7.43	3	1	6	3											3	6	1	1	2												
Canton	11,612	21	21.70	2	2	4												2	1	1	1	10	2											
Chillicothe	325,902	888	14.29	44	28	44	14											2	1	6	1	51	12											
Cincinnati	381,708	895	12.42	86	53	71	21	11										7	1	24	13	87	6											
Cleveland	125,160	128	12.27	16	12	21	1											12	1	181	10	56	3											
Columbus	125,160	128	12.27	16	12	21	1											5	28	7	23	8												
Dayton	85,333	102	14.34	15	7	16	1	2	5									5	35	8	21	15	4											
*East Liverpool																		3	1	3	8	7												
Findlay	20,000	14	8.40			3												3	2	1	1	6												
Hamilton	24,523	25	12.24	3	1	2												1	9	3	1	11	2											
Ironton	13,229	21	19.05	3		5	2											1	6	5	1	9												
Lima	31,314	26	9.96	6	4	11	4											2	4	4	4	5	1											
Mansfield	17,845	16	10.76		3	7	1	2										2	4	4	4	5	1											
Massillon	14,328	11	9.21			1												3	1	2	2	4												
Newark	20,886	11	6.47	2		1												1	2	1	2	1												
Portsmouth	13,346	15	13.49	1	2	1												1	6	2	6	7												
Sandusky	21,211	16	9.05	3		2												1	6	2	3	5												
Springfield	47,002	28	7.15	7	2	7	1	1										4	6	2	4	10	3											
*Steubenville																		1	2	1	2	5												
Tiffin	14,345	9	7.53			2	1											1	5	1	1	5												
Toledo	181,822	165	15.02	39	22	38	31	6										4	17	64	1	1	1											
Youngstown	66,217	54	9.78	10	7	14	2	1										8	24	1	8	24	1											
*Zanesville																			8	1	6	1												
Totals	1,366,010	1,464	12.58	239	143	256	83	27	10	1	1	9	3	1	115		62	2	294	70	143	648	33	29	33	44	48	118	36	1	77	152	92	132

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF OCTOBER, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Alliance	11,378	6	6.06	1	1	2												2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Bellaire	12,036	8	7.98	2	1	5		3										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Bucyrus	8,902	12	16.16			1												2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Circleville	7,524	9	14.35	1	1	1												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Defiance	9,759	8	9.84	1	1	1												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Delaware	9,639	13	18.67	1	1	1												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Fostoria	13,079	9	8.26	2	1	3												3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
*Fremont																																			
Galion	7,019	2	3.40																																
Galipolis	4,558	9	23.69			1												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Greenville	8,167	4	5.88			1		1																											
Kenton	7,598	7	11.06			2																													
Lancaster	8,302	11	15.90	1	2	4		1										2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Marietta	12,034	15	14.90	1	1	3												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Marion	16,484	12	8.74			1																													
Martin's Ferry	9,786	10	12.32			6		4										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Middletown	12,334	7	6.81		1	1																													
Mt. Vernon	6,825	5	8.77	1	1	1																													
Norwalk	8,367	6	8.12			1																													
Piqua	13,148	15	13.69	1	1	2												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
*Pomeroy																																			
Salem	7,976	3	4.51			1																													
Troy	5,222	12	27.57	1	1	1																													
Urbana	6,750	7	12.46			1																													
Warren	8,573	8	11.20	3	3	1																													
Washington C. H.	8,339	7	10.03	1	1	1																													
Wellston	8,000	10	15.00	3	2	4																													
Wellsville	7,900	4	6.15	2	1	1																													
Wooster																																			
Xenia	7,557	8	12.70	1		4																													
Totals	248,156	239	11.03	22	17	55	7	7	6	4	2	1	1	1	1	1	1	21	1	47	9	26	105	11	8	6	7	10	17	9	12	5	14	8	

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF NOVEMBER, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.		
*Akron	30,667	18	6.96	2	5	6	5													1	3	3	2	5	5	1	1	2	3	1	1	1	3	1	1		
Canton	11,612	11	11.40	1	1	2	2														3	3	7	2	6	1	1	1	8	2	2	2	2	2	2		
Chillicothe	325,902	381	14.04	89	21	35	10	1												4	81	7	54	212	12	22	5	11	39	6	30	32	21	34	34		
Cincinnati	381,768	380	11.88	79	41	51	17													10	26	4	13	187	10	6	3	23	12	27	14	1	46	54	20	26	54
Cleveland	125,160	111	10.68	14	10	15	5	1												4	26	3	23	56	8	7	4	6	6	9	5	12	5	9	5	12	5
Columbus	85,833	84	11.76	8	5	13	2													1	23	8	11	37	8	7	1	3	4	11	1	1	1	5	6	13	13
*Dayton																																					
*East Liverpool	20,000	13	7.80																		1	1	1	7	1	3	1	1	3	1	1	1	2	3	1	1	
Findlay	24,523	19	9.29	3	1	5	2													1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	
Hamilton	13,229	13	11.78	2	2	7														2	9	1	4	1	4	1	1	1	1	1	1	1	1	1	1	1	
Ironton	31,314	30	11.52	2	2	7														1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	
Lima	17,845	10	6.72																		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mansfield	14,323	15	12.56																		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Massillon	20,856	13	7.65																	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Newark	13,346	22	19.78	2	1	1															1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Portsmouth	21,211	17	9.61	2	1	4														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Sandusky	47,002	40	10.42	4	3	5														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
*Springfield																																					
*Steubenville																																					
Tiffin	14,345	9	7.53																		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Toledo	131,522	142	12.92	24	29	41	24													24	15	48	5	5	1	7	4	5	1	7	4	5	1	7	4	5	
Youngstown	66,217	42	7.61	7	4	16	3	1												7	1	4	3	15	1	1	1	1	1	1	1	1	1	1	1	1	1
*Zanesville																																					
Totals	1,396,010	1,370	11.06	191	126	212	72	4	4	4	8	3	1	4	11	1	43	6	249	46	142	656	48	36	32	51	34	114	34	1	112	146	78	127			

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF DECEMBER, 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population estimated.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhœal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
*Akron	30,667	27	10.56	5	5	8	5	5										2		5	1		10	1		1		1		3	1		4	3	1
Canton	11,612	17	17.57	2	4	3	8											1		5			9			2		1						1	
Chillicothe	11,912	441	16.05	66	26	42	10	2	1	1	3	1	1	3	1	1	3	10		106		72	220	18		5	19	8	7	40	8	34	48	35	
Cincinnati	325,992	437	13.68	78	44	52	15	1										6	3	57		9	11	221	14	5	20	12	24	14	47	47	25		
Cleveland	381,768	135	12.84	13	16	25	5	1	9		3							3		28		17	54	5	3		2	1	13	2	10	14	9		
Columbus	125,160	93	13.08	6	2	10			7											20		7	9	52	11	4	1	1	5	14		6	5	6	
Dayton	85,333																																		
*East Liverpool		17	10.20			4												4		1		1	10											2	
Findlay	20,000	22	10.68	4	2	3												1		8		2	1	9	1		1		4					3	
Hamilton	24,523	22	10.68	4	2	3												1		8		2	1	9	1		1		4					3	
Lancaster	13,220	12	11.01	2	1	1												1		4		1	3	6	1		1		1					1	
Lima	31,314	17	6.45	1		5												1		4		1	3	6	2		1		1					1	
Mansfield	17,845	8	5.40	2		1												1		1		1	5	1			1		1					1	
Massillon	14,328	5	4.32			1												1		1		1	5	1			1		3					3	
Massillon	14,328	21	12.36			4												1		5		3	12	1			2		6					1	
Newark	20,386	16	17.88	3		4												1		2		7	17				2		3					1	
Portsmouth	13,346	20	9.00		3	5	2																					1		2					2
Sandusky	21,211	16	9.00		3	5	2																					1		2					1
*Springfield	17,002	33	8.40	2	4	6	3											1		1		7	17				2		3					2	
*Shenando																																			
Shenando	14,345	9	8.04			1																						1		1					1
Tiffin	136	12.36	21	24	26	12												5		17		5	68	1		5	2	8	5	9	1	9	18	16	
Toledo	66,217	50	9.00	12	1	8	1											2		7		1	20	1			2		2		5	4	8	11	
Youngtown																																			
*Zanesville																																			
Totals	1,396,010	1,516	13.03	220	136	206	58	5	17	6	8			1	6	14	3	37	7	283	47	146	739	57	28	37	48	39	136	31	131	147	96	158	

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF DECEMBER, 1899.

Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Alliance	11,878	12	12.15	1	4	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	3	3	5	1	1	1	1	1	1	1	1	1	1	1	
Bellaire	12,036	13	12.96	5	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Bucyrus	8,902	5	6.74	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Circleville	7,524	4	6.40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Defiance	9,759	3	3.69	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Delaware	9,639	5	6.23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Fostoria	13,079	8	7.36	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
*Fremont	7,019	4	6.84	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Gallion	4,558	1	44.76	1	3	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Gallipolis	8,167	4	5.88	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Greenville	7,598	6	9.48	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Kenton	8,302	12	17.34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Lancaster	12,084	13	12.90	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Marietta	9,736	6	7.40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Marion	12,334	7	6.81	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Martin's Ferry	6,825	3	5.27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Middletown	8,867	7	9.46	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mt. Vernon	13,148	17	15.52	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Norwalk	7,576	8	12.04	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Piqua	5,222	9	20.07	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Pomeroy	6,750	8	14.22	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Salem	8,573	8	11.20	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Troy	8,339	7	10.08	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Urbana	8,000	10	15.00	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Warren	7,800	8	12.81	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Washington C. H.	7,557	8	12.70	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Wellsboro	231,672	212	10.94	13	11	28	4	...	2	1	1	1	2	2	2	2	2	2	5	2	49	11	27	99	13	9	4	2	5	36	4	13	13	13	13
Wellsville																																			
Wooster																																			
Xenia																																			
Totals																																			

* No report received.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE YEAR 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrheal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Akron	30,667	330	10.76	58	34	62	26	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	
Antion	11,612	231	19.90	25	20	49	5	8	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Chillicothe	325,902	5,838	17.91	903	558	876	104	50	64	12	28	31	56	9	13	3	121	1	11	3	71	8	27	127	10	3	9	6	18	20	4	47	57	10	3	
Cincinnati	381,708	5,488	14.38	1356	872	834	120	151	32	6	13	20	2	2	5	86	6	118	26	780	185	176	2642	132	73	86	127	434	232	5	451	463	331	505		
Cleveland	125,160	1,622	12.96	204	106	267	14	52	12	8	3	15	1	3	1	1	31	6	401	59	222	730	55	64	10	37	38	128	53	1	106	148	293	393		
Columbus	85,333	1,211	14.19	202	75	200	7	18	64	4	5	25	4	1	4	2	1	31	2	304	55	181	559	74	71	17	32	33	120	37	2	84	75	101		
Dayton	20,145	121	6.01	46	18	36	3	8	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
East Liverpool	20,000	228	11.40	46	18	36	3	8	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Findlay	24,523	310	12.64	51	18	62	6	3	35	2	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Hamilton	13,229	198	14.97	30	21	35	4	2	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Ironton	31,314	318	10.16	66	25	52	3	6	3	2	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Lima	17,845	186	10.42	12	10	45	8	6	3	2	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Mansfield	14,328	136	9.50	15	6	15	6	8	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Massillon	20,386	213	10.45	33	16	42	8	6	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Newark	13,316	214	16.04	39	16	42	8	6	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Portsmouth	21,211	223	10.51	39	24	52	4	6	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Sandusky	47,062	514	10.91	79	31	100	6	14	36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Springfield	14,345	127	8.85	15	9	14	3	8	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Steubenville	131,822	1,832	13.90	421	238	481	161	78	15	28	77	10	8	5	8	16	40	11	276	69	162	731	35	39	28	68	50	109	53	1	134	225	113	188		
Tiffin	66,217	664	10.03	169	60	160	9	37	25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Toledo	24,008	294	12.25	41	17	39	2	8	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Youngstown	1,440,163	20,298	14.09	3756	1852	3487	501	475	308	58	133	135	23	70	42	89	10	533	73	3772	667	1849	9563	584	443	543	734	537	1301	694	22	1646	2629	1131	1614	
Totals																																				

* No report received.

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Cities of less than 10,000 inhabitants (census of 1900).	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhæal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.			
Alliance	11,875	103	8.67	16	16	20	1	7	9	6	1	1	1	1	1	1	1	1	8	43	3	14	37	...	...	...	2	4	4	11	1	1	18	2	4	16	
Bellaire	12,036	146	12.13	26	31	36	3	7	9	6	1	1	1	1	1	1	1	2	28	30	1	16	70	6	...	...	3	4	1	12	1	12	18	2	4	16	
Bucyrus	8,902	68	7.64	13	7	14	...	7	1	1	1	1	1	1	1	1	1	2	18	10	1	12	48	1	...	...	3	2	1	12	...	12	3	2	4	16	
Circleville	7,524	103	13.69	16	6	10	...	1	1	1	1	1	1	1	1	1	1	3	1	4	4	12	70	...	...	3	3	1	10	...	13	11	...	5	2	12	
Defiance	9,759	63	6.46	...	...	...	...	1	1	1	1	1	1	1	1	1	1	3	1	4	4	12	70	...	...	2	4	1	10	...	13	11	...	5	2	12	
Delaware	9,639	104	10.79	15	25	16	...	1	1	1	1	1	1	1	1	1	1	5	24	4	5	11	41	6	...	...	4	3	1	10	...	13	11	...	5	2	12
*Fostoria	13,079	87	6.65	21	4	18	...	6	1	1	1	1	1	1	1	1	1	5	24	4	5	11	43	1	...	...	4	3	1	12	1	1	8	...	12	12	
Fremont	7,019	55	7.84	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	17	1	1	12	27	2	...	...	2	3	4	2	...	9	...	6	...	1	...
Galion	4,558	101	22.16	11	7	18	...	4	...	...	...	...	...	...	...	...	...	7	15	1	1	12	13	18	...	...	1	2	1	1	...	6	...	2	...	1	...
Gallipolis	8,167	62	7.59	9	2	11	1	4	4	1	1	1	1	1	1	1	1	2	16	4	11	18	2	...	...	1	1	1	1	...	6	...	2	...	1	...	
Greenville	7,508	82	10.80	3	...	...	...	1	4	1	1	1	1	1	1	1	1	3	16	4	11	18	2	...	...	1	1	1	1	...	6	...	2	...	1	...	
Kenton	13,494	11	8	23	8	4	...	1	2	1	1	1	1	1	1	1	1	5	3	35	3	24	50	10	...	...	3	2	19	8	...	1	...	13	2	4	15
Lancaster	8,302	123	14.94	11	8	23	8	4	2	2	1	1	1	1	1	1	1	5	1	25	9	11	75	9	...	...	6	1	14	11	...	18	...	9	...	3	15
Marietta	12,084	163	13.49	15	9	36	1	6	6	...	3	1	1	1	1	1	1	5	1	25	9	11	75	9	...	...	3	2	14	11	...	18	...	9	...	3	15
Marion	9,736	80	8.22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	17	2	10	21	2	...	...	2	7	5	...	...	4	...	10	...	4	10	
*Martin's Ferry	12,334	104	8.43	11	8	14	...	2	10	7	1	1	1	1	1	1	1	2	1	26	9	15	58	9	...	...	5	7	5	...	...	7	...	6	...	8	...
Middletown	6,825	88	12.89	9	4	14	...	4	2	2	2	1	1	1	1	1	1	1	13	2	11	41	7	...	...	1	6	11	3	...	...	1	...	13	2	4	...
Mt. Vernon	8,867	69	7.78	1	2	1	1	1	1	1	1	1	1	16	4	9	45	2	9	1	8	10	1	5	...	7	...	1	...
Norwalk	13,148	138	10.49	20	8	17	...	5	1	1	1	1	1	1	1	1	1	5	30	9	17	72	4	6	3	5	6	15	11	...	7	...	12	...	4	...
Piqua	7,976	80	10.03	12	2	13	...	2	...	1	1	1	1	1	1	1	1	5	1	24	4	6	47	4	...	...	5	3	15	3	...	6	...	1	...	4	...
*Pomeroy	5,222	89	17.04	3	6	8	...	...	2	1	1	1	1	1	1	1	1	2	39	5	21	31	6	...	...	6	3	2	3	...	...	1	...	5	...	6	...
Salem	6,750	93	13.77	6	5	15	...	1	3	1	1	1	1	1	1	1	1	2	22	4	6	47	4	...	...	5	3	2	3	...	...	1	...	5	...	6	...
Troy	8,573	113	13.12	19	7	16	...	3	3	1	1	1	1	1	1	1	1	2	22	4	6	47	4	...	...	5	3	2	3	...	...	1	...	5	...	6	...
Urbana	8,339	77	9.24	6	5	13	...	2	...	2	1	1	1	1	1	1	1	2	16	4	10	25	3	...	...	1	2	1	1	...	...	7	...	13	...	3	...
Washington C. H.	8,000	124	15.50	16	32	61	2	7	8	2	1	1	1	1	1	1	1	4	17	4	12	37	5	...	...	3	1	1	1	...	...	9	...	17	...	10	...
Wellston	7,800	108	13.85	20	9	42	2	3	5	1	1	1	1	1	1	1	1	2	23	3	7	37	1	...	...	2	2	1	1	...	...	5	...	9	...	10	...
Wellsville	7,557	117	15.50	9	3	23	...	3	6	...	...	...	...	...	...	...	...	5	23	7	16	43	4	...	...	3	2	2	1	...	...	6	...	21	...	5	...
*Wooster	7,557	117	15.50	9	3	23	...	3	6	...	...	...	...	...	...	...	...	5	23	7	16	43	4	...	...	3	2	2	1	...	...	6	...	21	...	5	...
Xenia	7,557	117	15.50	9	3	23	...	3	6	...	...	...	...	...	...	...	...	5	23	7	16	43	4	...	...	3	2	2	1	...	...	6	...	21	...	5	...
Totals	231,672	2,540	10.97	287	204	510	35	78	65	228	171	1628	1210	1	85	111	590	102	320	1121	109	77	46	55	63	260	90	3	173	125	109	149		

* No report received.

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ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING TOWNSHIPS OF OHIO DURING THE YEAR 1899.

Cities of 10,000 inhabitants (census 1900) or over.	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrhœal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Coshocton—																																				
Adams	1,138	8	7.02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Bethlehem	766	4	5.22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Franklin	1,042	1	9.96	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Jackson	1,628	13	7.99	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Keene	783	5	6.89	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Linton	1,599	9	5.63	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Monroe	1,031	14	13.60	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Newcastle	892	3	3.36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Tuscarawas	1,056	11	1.04	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
White Eyes.....	1,048	5	4.77	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Crawford—																																				
Chafield	1,201	2	1.67	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Holmes	1,423	6	4.21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Jefferson	754	8	10.61	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Sandusky	615	6	9.75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Cuyahoga—																																				
Bedford	961	5	5.20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Brookville	1,025	10	9.76	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Brooklyn	1,617	16	9.89	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Euclid	3,780	32	8.47	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Olmsted	1,484	25	16.84	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Royalton	1,116	5	4.48	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Strongsville	1,023	10	9.78	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

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ABSTRACT OF THE REPORTS OF DEATHS AND THEIR CAUSES, IN OHIO, DURING THE YEAR 1899.

	Population (estimated).	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrheal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.
Cities over 10,000.....	1,440,163	20,298	14.09	8,756	1,852	3,487	501	475	308	58	153	135	23	70	42	89	10
Cities under 10,000.....	231,672	2,540	10.97	510	204	510	35	78	45	2	28	17	16	28	12	10	1
Villages (250).....	485,255	5,335	10.99	524	281	1,066	147	221	131	11	34	57	16	17	23	55	17
Townships (440).....	603,630	4,136	6.85	226	138	964	171	111	77	13	26	30	25	11	13	87	11
Total	2,760,720	32,300	11.70	4,763	2,475	6,127	854	885	581	84	241	239	80	126	90	241	39

	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Cities over 10,000.....	553	73	3,772	697	1,849	9,563	584	443	543	734	557	1,501	694	22	1,646	2,020	1,131	1,611
Cities under 10,000.....	85	11	590	102	320	1,121	109	77	46	55	63	260	90	3	173	125	109	149
Villages (250).....	215	37	1,007	196	561	2,140	227	179	63	92	146	483	87	11	370	218	259	289
Townships (440).....	219	84	732	136	418	1,640	165	153	37	53	62	390	49	12	308	156	152	213
Total	1,072	155	6,101	1,131	3,148	14,464	1,085	852	689	934	828	2,634	920	48	2,497	2,528	1,651	2,265

SUMMARY OF MORTALITY REPORTS.

The total number of deaths reported from all causes—excluding premature and still-births—by the cities, villages and townships represented in the foregoing tables was 32,309. The average estimated population of the cities, villages and townships represented was 2,760,720, which is equal to an annual death rate of 11.70 per thousand living population represented.

The deaths in 2,705,126 living population (estimated) in 1898 were 29,346, equal to an annual death rate of 10.85 per thousand; while in 1897 the total number of deaths reported in 2,141,781 population (estimated) was 26,215, equal to a mortality rate of 12.24 per thousand.

DEATHS OF CHILDREN UNDER FIVE YEARS OF AGE.

The number of deaths reported of children under five years of age (premature and still-born excluded), was 7,268, which is equal to 22.5 per cent. of the deaths from all causes, and a death rate of 2.6 per thousand population represented. The death rate of children under five the preceding year was 2.52 per thousand population represented.

ZYMOTIC DISEASES.

The total number of deaths reported from zymotic diseases was 6,127, which is equal to 18.9 per cent. of the deaths reported from all causes, and an annual rate of 2.2 per thousand of the population represented.

The number of deaths reported the preceding year from zymotic diseases was 4,997, equal to a death rate of 1.85 per thousand population represented.

CROUP AND DIPHTHERIA.

The total number of deaths reported from croup and diphtheria was 854, which is equal to 2.6 per cent. of the deaths reported from all causes, and a death rate of .3 per thousand of the population represented.

The number of deaths reported the preceding year from these causes was 747, equal to a mortality rate of .3 per thousand of the population represented.

CHOLERA INFANTUM, CHOLERA MORBUS, AND DIARRHŒA.

The total number of deaths reported from cholera infantum, cholera morbus and diarrhœa was 1,210, which is equal to 3.8 per cent. of the deaths reported from all causes, and a mortality rate of .4 per thousand population represented.

The number of deaths reported the preceding year from these causes was 1,120, which is equal to a mortality rate of 4 per thousand of the population represented.

MEASLES, SCARLET FEVER AND WHOOPING COUGH.

The total number of deaths reported from measles, scarlet fever and whooping cough was 522, which is equal to 1.6 per cent. of the total number of deaths reported from all causes, and a mortality rate of .19 per thousand of the population represented.

The total number of deaths reported from these diseases during the preceding year was 458, equal to a mortality rate of .17 per thousand population represented.

TYPHOID FEVER.

The total number of deaths reported from typhoid fever was 1,072, which is equal to 3.3 per cent. of the total number reported from all causes, and a mortality rate of .39 per thousand population represented.

The number of deaths reported from this cause the preceding year was 923, equal to a mortality rate of .34 per thousand living population represented.

CONSTITUTIONAL DISEASES.

The total number of deaths reported from constitutional diseases was 6,101, which is equal to 18.8 per cent. of the deaths reported from all causes, and a mortality rate of 2.2 per thousand population represented.

The number of deaths reported from constitutional diseases the preceding year was 5,471, equal to a mortality rate of 1.9 per thousand population represented.

CANCER.

The total number of deaths reported from cancer was 1,131, which is equal to 3.5 per cent. of the deaths reported from all causes, and a mortality rate of .41 per thousand population represented.

The number of deaths reported from this cause the preceding year was 1,044, equal to a mortality rate of .39 per thousand population represented.

CONSUMPTION

The total number of deaths reported from consumption was 3,148, which is equal to 9.8 per cent. of the deaths reported from all causes, and a mortality rate of 1.14 per thousand population represented.

The number of deaths reported from this cause the preceding year was 3,232, equal to a mortality rate of 1.19 per thousand population represented.

LOCAL DISEASES.

The total number of deaths reported from all local diseases was 14,464, which is equal to 44.8 per cent. of the deaths reported from all causes, and a mortality rate of 5.2 per thousand population represented.

The number of deaths reported from all local diseases the preceding year was 13,576, equal to a mortality rate of 5. per thousand population represented.

BRONCHITIS, PLEURISY AND PNEUMONIA.

The total number of deaths reported from bronchitis, pleurisy and pneumonia was 3,234, which is equal to 10.01 per cent. of the deaths reported from all causes, and a mortality rate of 1.2 per thousand of the population represented.

In the preceding year there were 3,075 deaths reported from these causes, equal to a mortality rate of 1.1 per thousand population represented.

CONVULSIONS AND MENINGITIS.

The total number of deaths reported from convulsions and meningitis was 1,854, which is equal to 5.7 per cent. of the deaths reported from all causes, and a mortality rate of .67 per thousand population represented.

The number of deaths reported from these diseases the preceding year was 1,738, equal to a mortality rate of .64 per thousand population represented.

DEVELOPMENTAL DISEASES.

The total number of deaths from developmental diseases reported (excluding premature and still-births) was 2,528, which is equal to 7.8 per cent. of the deaths reported from all causes, and a mortality rate of .92 per thousand population represented.

During the preceding year there were 2,445 deaths reported from developmental diseases, equal to a mortality rate of .9 per thousand population represented.

VIOLENCE.

The total number of deaths reported from violence was 1,651, which is equal to 5.1 per cent. of the deaths reported from all causes, and a mortality rate of .6 per thousand population represented.

During the preceding year there were 1,579 deaths reported from violence, equal to a mortality rate of .58 per thousand population represented.

PREMATURE AND STILL-BIRTHS.

The total number of premature and still-births reported was 2,265, which is equal to 7.0 per cent. of the deaths reported from all causes, and a rate of .79 per thousand population represented.

During the preceding year there were 2,403 premature and still-births reported equal to a rate of .89 per thousand population represented.



STATE BOARD OF HEALTH
MAP OF
MUSKINGUM WATERSHED
SHOWING SUBSIDIARY WATERSHEDS,
SAMPLE POINTS, DATS, ETC.
1899

APPENDIX I.

THIRD REPORT OF AN
INVESTIGATION

OF

THE RIVERS OF OHIO

AS SOURCES OF PUBLIC
WATER SUPPLIES.

BY THE OHIO STATE BOARD OF HEALTH.

1900.

THIRD REPORT UPON THE EXAMINATION OF SOURCES OF PUBLIC WATER SUPPLIES.

The examination of rivers as sources of public water supplies begun in 1897, has been continued. The Muskingum river and its tributaries have occupied attention during the present year, 1899.

The Board has now examined the Scioto, Olentangy, Mahoning, Sandusky, Maumee and Muskingum rivers, with all their branches. There remain the two Miami rivers to be examined to complete all the streams of the state, excepting the Ohio river. As this is an interstate stream presenting problems quite different in many respects from other Ohio streams, it will require a somewhat different treatment.

The Muskingum river has the largest water-shed in Ohio of any of our streams, with a total area of 7,797 square miles. The total estimated population upon this water-shed for 1900 is 388,482, or 77 per square mile. Of this population 217,593 may be classed as urban.

Observation stations were established at the following places: Canton, Massillon, Canal Dover, New Philadelphia, Uhrichsville and Denison, Coshocton, Zanesville, McConnelsville, Marietta, Shelby, Mansfield, Mt. Vernon, Wooster, Newark and Cambridge. Samples of the river water were collected for chemical and bacteriological examination at each of these stations monthly during April, May, June, July, August, September, October and November. The methods used were the same as those used last year, a full description of which was published in the last, the Thirteenth Annual Report of the Board. During the present year measurements were made of the turbidity of the stream at the various stations by the method recommended by Mr. Allen Hazen. A description of this method will be found in the chemist's report. The amount and character of suspended matter carried by streams at different times is of the utmost importance when it becomes necessary to filter the water. While the turbidity measurements of the Muskingum river made this year were too infrequent to serve as a foundation for positive conclusions, they will, nevertheless, it is hoped, be of some service to those cities which may be compelled to filter this water for a public supply.

The measurement of the flow of streams, in connection with the U. S. Geological Survey, has been carried on during the year. The data obtained is being carefully compiled for publication in a future report.

The Engineer has inspected the entire water-shed, noting the location, and measuring as far as possible, the amount of the various sources of pollution. He has also collected interesting information concerning the water works and sewerage systems of the various cities and villages

upon the water-shed. Cambridge, Canton, Dennison, Uhrichsville, Wooster and Zanesville, are the only cities making use of the Muskingum river or its branches as a source of public water supply.

Canton is supplied by deep wells, but is obliged to make use, at times, of the west branch of the Nimishillen creek to augment the well supply. The city has recently located some new wells, which showed a good flow of excellent water, and the use of surface water, it is expected, will be entirely abandoned.

Cambridge has been obtaining water from Wills creek, a source of supply which was approved by the State Board of Health only upon the agreement that the water would not be used for domestic purposes. This city has recently constructed two large filtration wells which will yield a water of fairly good quality, and which, it is hoped, will furnish a sufficient quantity to allow the discontinuance of all surface water.

Dennison and Uhrichsville have a common water supply taken from Big Stillwater creek. The water company has recently introduced a filtration plant which was approved by the State Board of Health.

Wooster, for several years, has been obliged each season, during the dry months, to make use of Apple creek for a part of its supply. This creek is much polluted, and has been condemned by the State Board of Health. The public supply is but little used for domestic purposes, on account of its bad reputation, and this has forced the citizens to make use of private wells, many of which are badly polluted. The result has been a very considerable prevalence of typhoid fever in Wooster. We may thus see how a badly polluted public water supply may be indirectly the cause of disease. Wooster is the worst off, as regards water supply, of all the cities upon the Muskingum water-shed, and steps should be taken at once to secure a more desirable supply.

Zanesville is supplied with water from the Muskingum river. During the past winter plans for obtaining a new supply from wells upon the banks of the river were presented to the Board for approval. The water is apparently of good quality, but the investigation was not carried far enough to determine the probable yield of this ground water supply. Later the city took up the investigation of the question of introducing filters and continuing to use the Muskingum river as a source of supply.

It will thus be seen that what pollution there is at the present time of the Muskingum river and its branches does not greatly affect any of our public water supplies, except that of Wooster, and that recent changes, with improvements promised for the near future, will remove practically all danger.

The degree of pollution of this stream, except at one or two places upon its tributaries, is also less than that of any other of the streams examined. At Mansfield, however, the pollution is most marked, as a small stream here is receiving a very considerable amount of sewage. Suits have been brought against the city for damages on account of this pol-

lution. There is now a strong sentiment in Mansfield in favor of sewage purification works, and there is reason to hope that this improvement will be made soon. The Ohio State Reformatory at Mansfield, a large institution using the same stream as Mansfield to carry away its sewage, has sewage purification beds in operation, which are giving fair results.

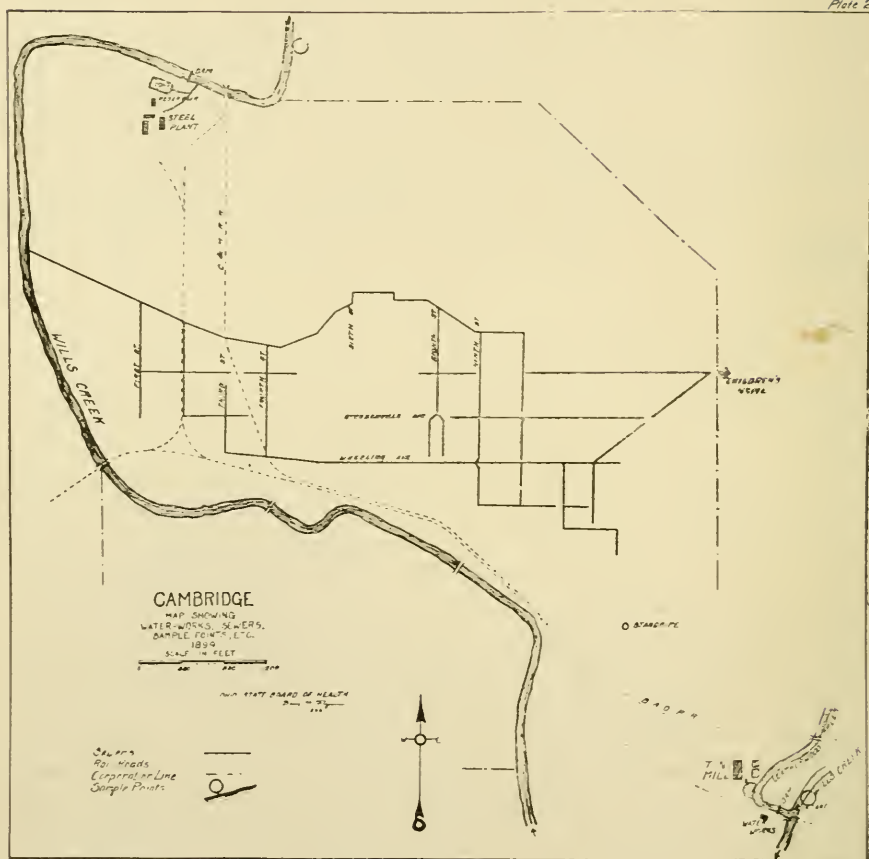
Shelby, on a small stream tributary to the Muskingum, has provided for sewage purification works, which will be introduced in the near future.

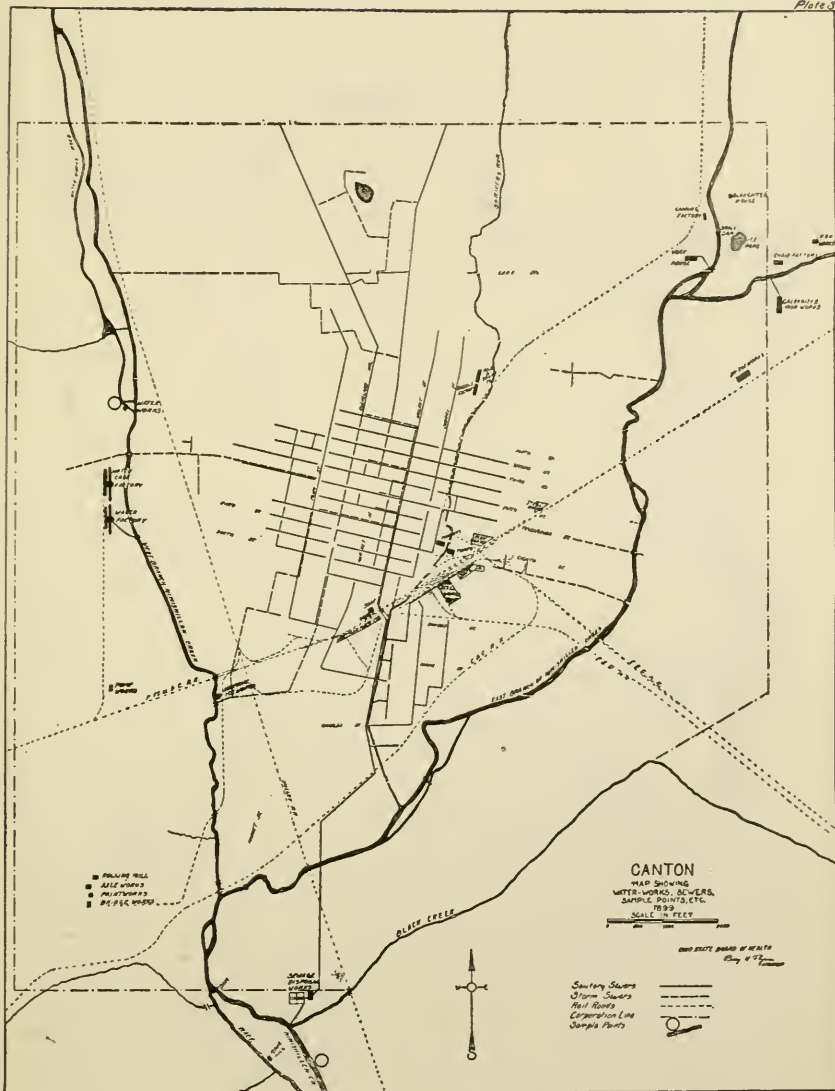
Canton, also on a small tributary, has had chemical precipitation works in successful operation for some years.

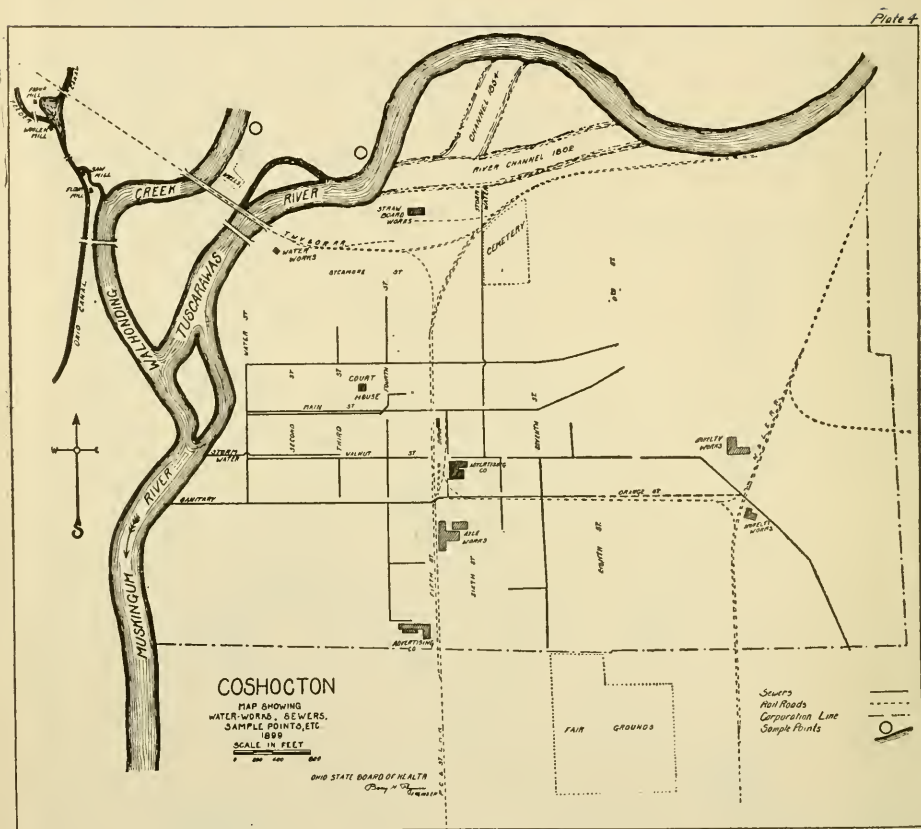
On the whole, it may be said that the trunk and main branches of the Muskingum river are reasonably free from pollution.

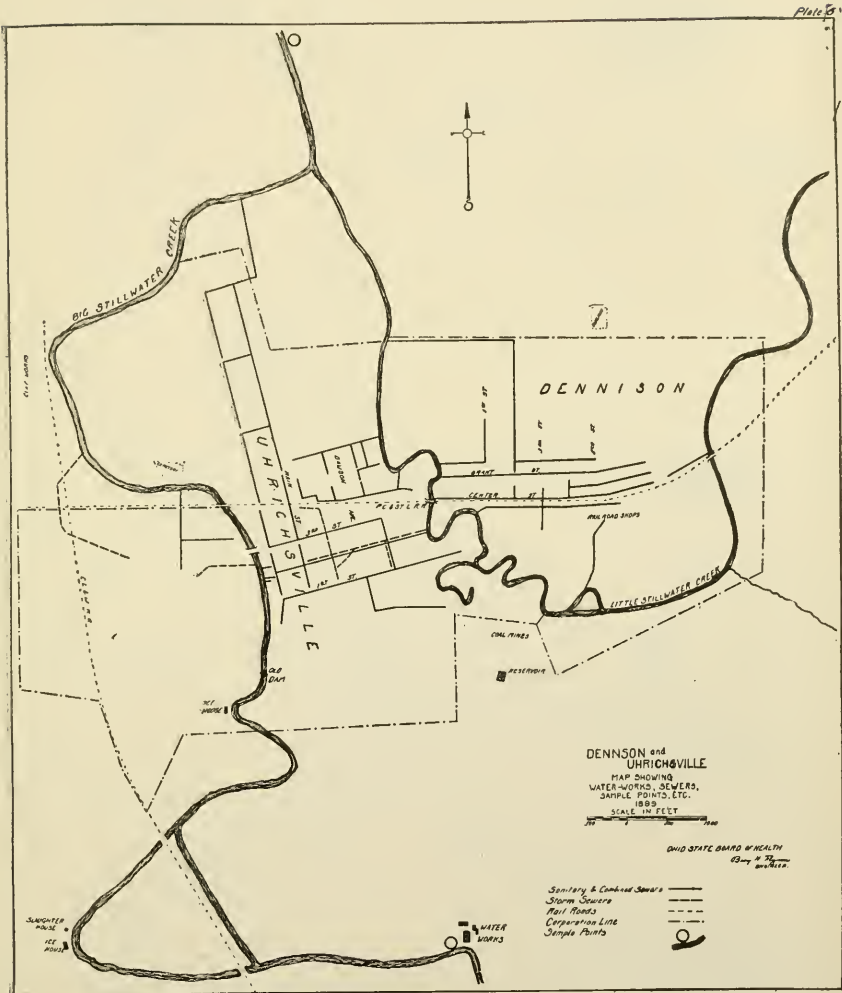
Some of the smaller tributaries are already receiving sewage to their maximum capacity, so that growing cities upon them must expect in the near future to provide methods for sewage purification, if additional sewage is to be discharged into the streams.

A detailed account of this examination of the Muskingum river is given in the reports of the Chemist, Bacteriologist and Engineer, which follow.









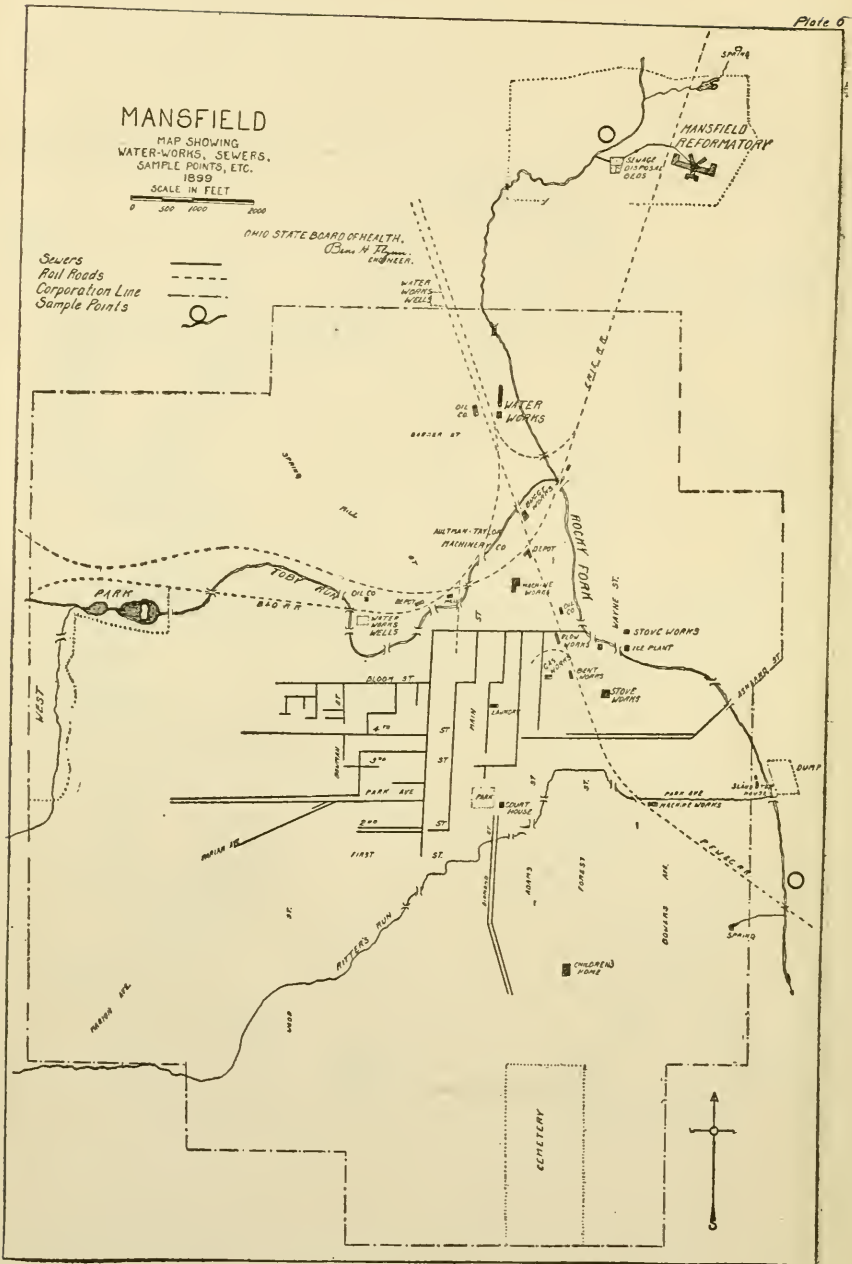


Plate 7

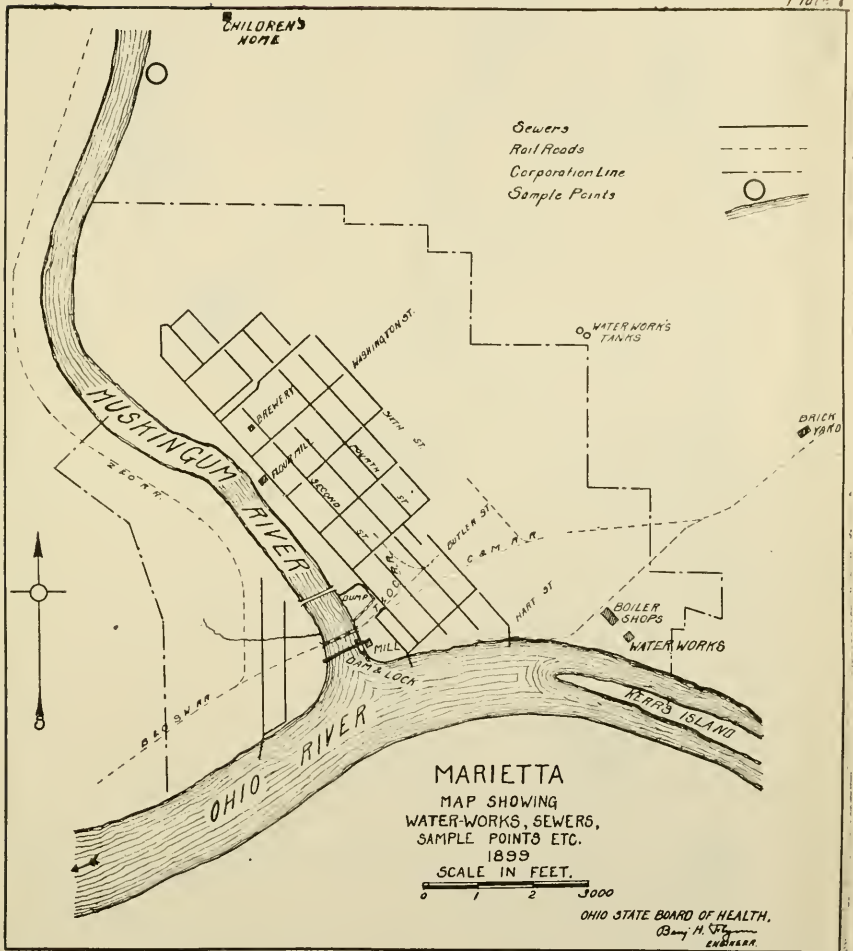
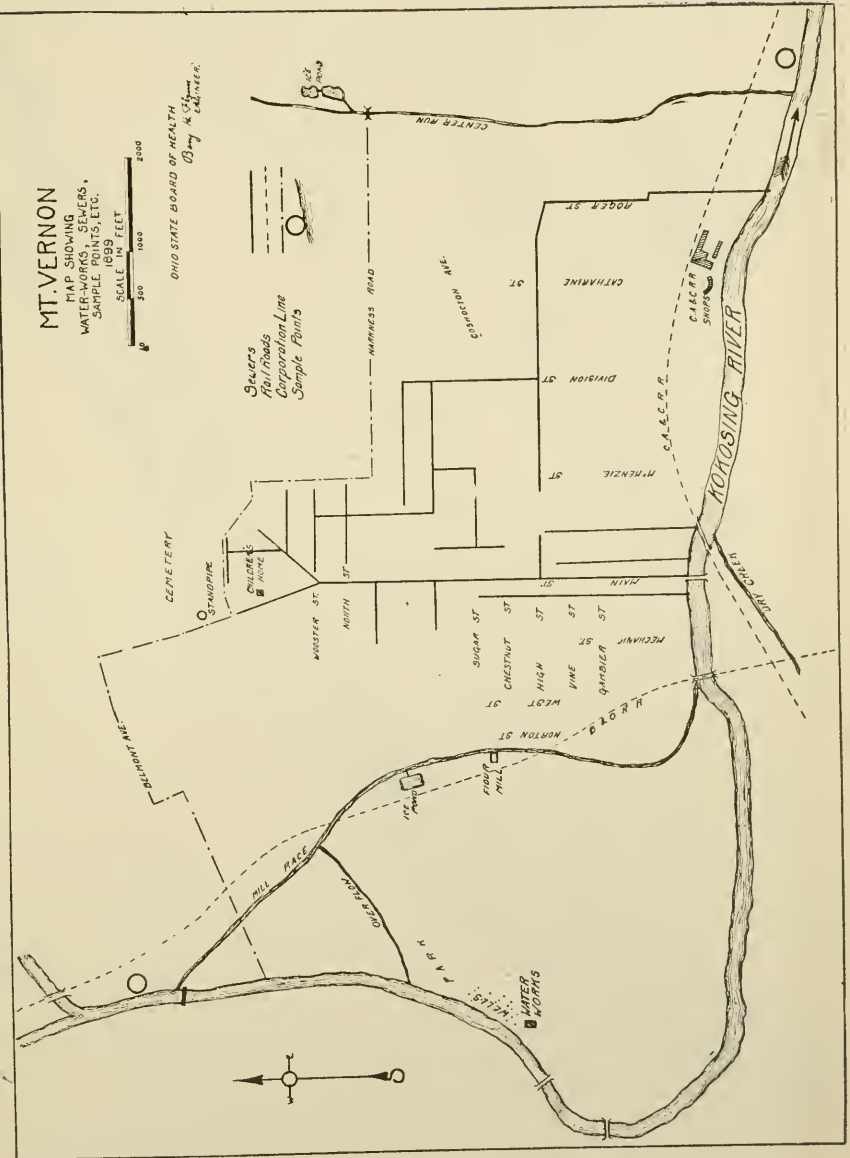


Plate 9



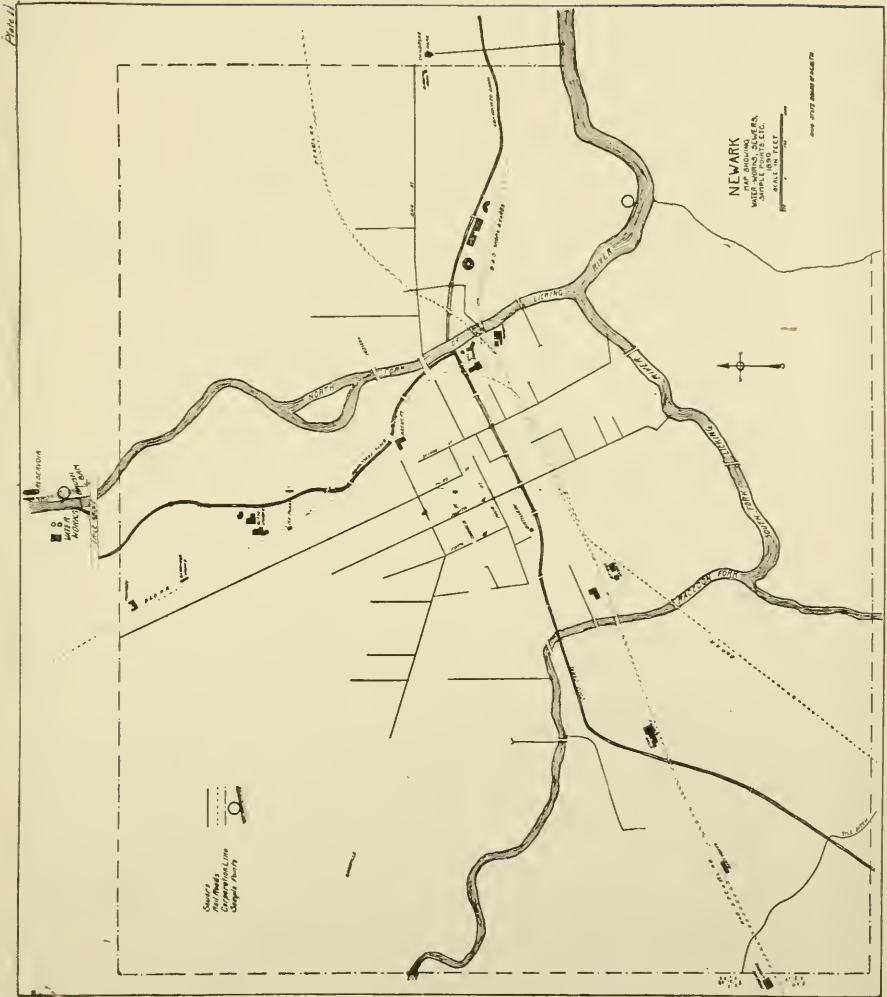
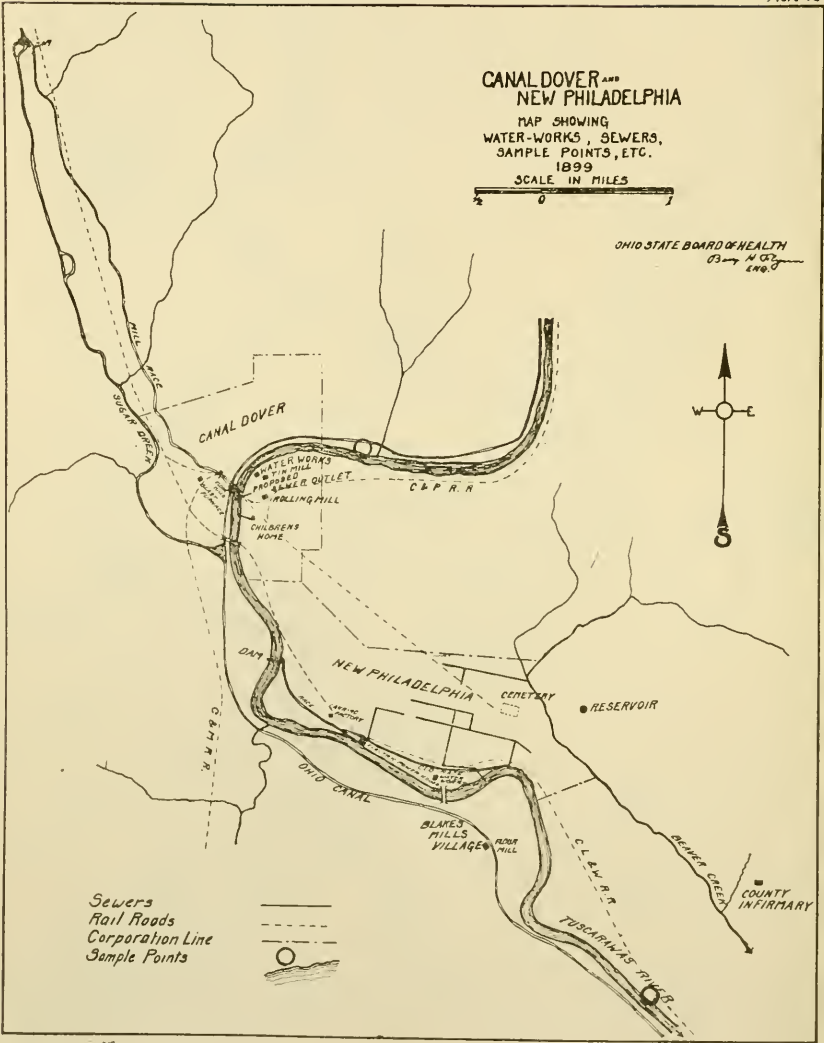


PLATE 12



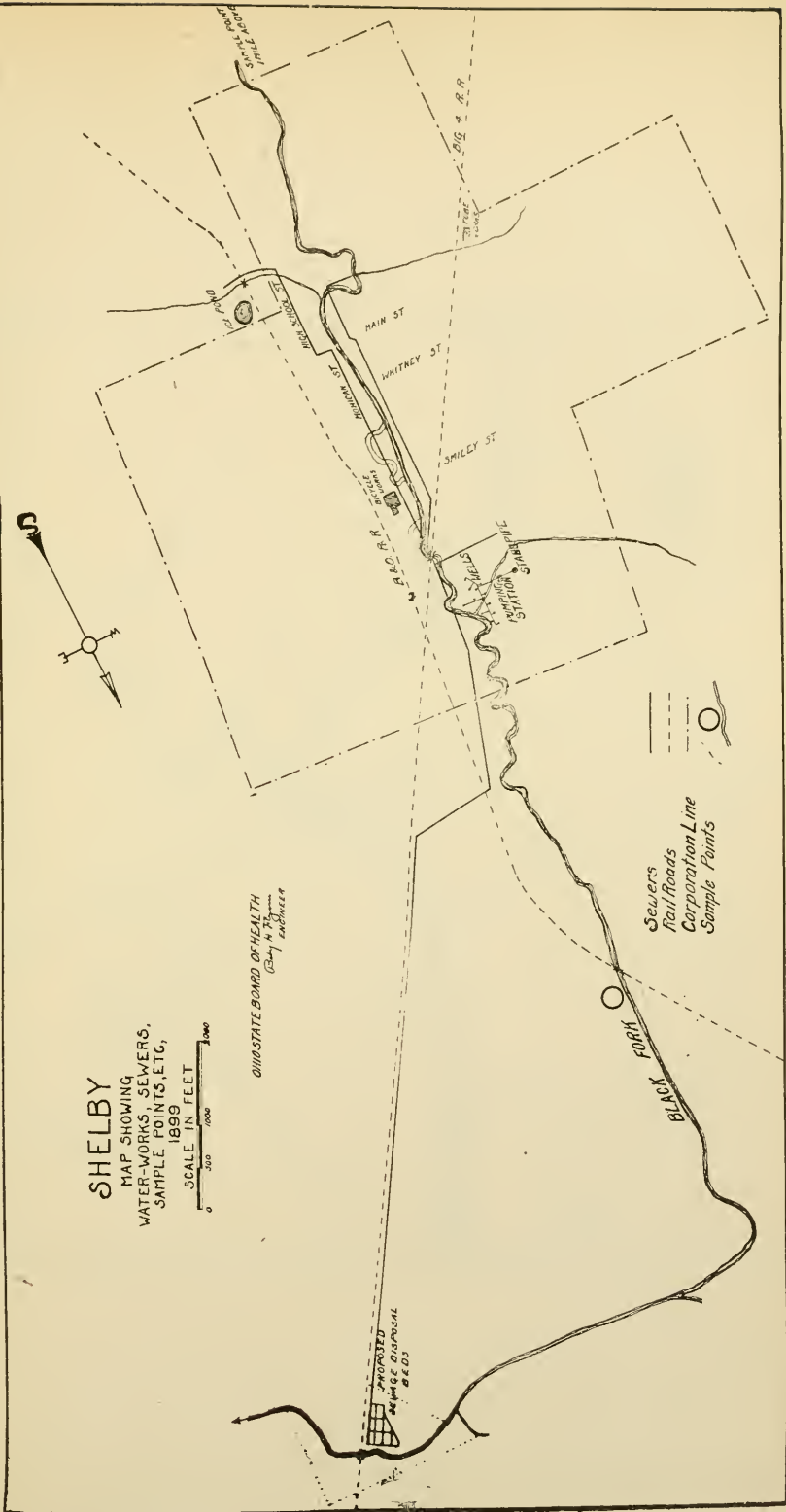


Plate 15

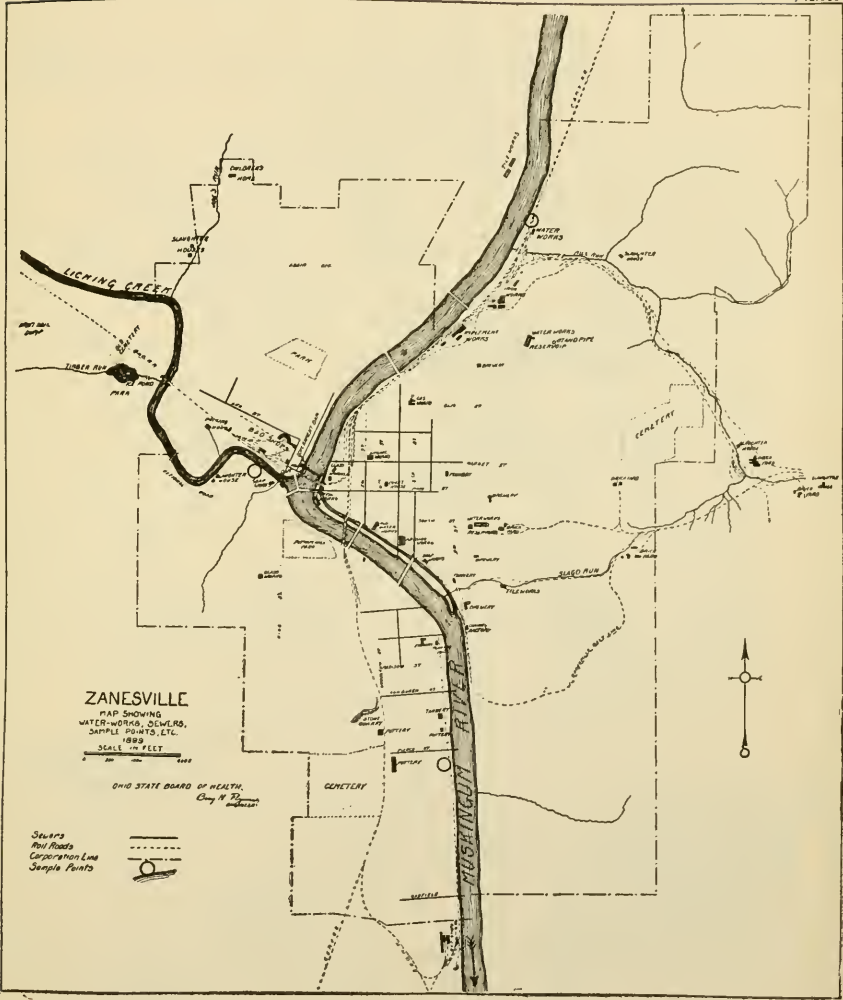
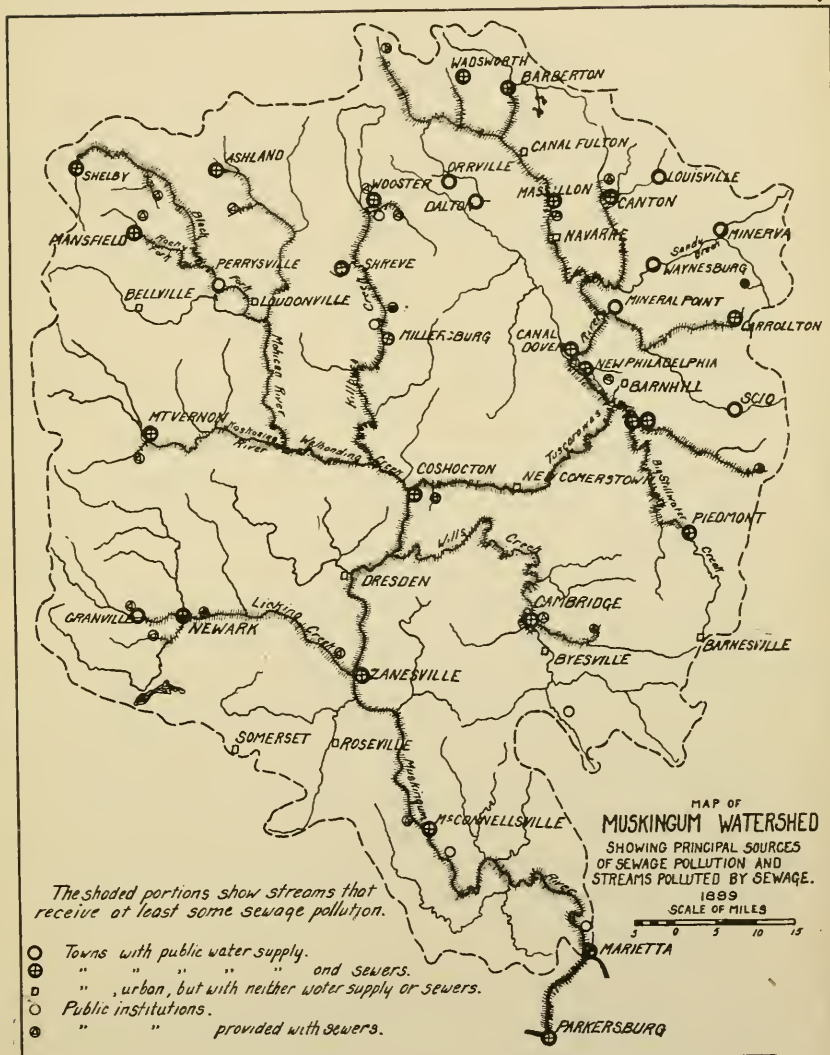




Plate 17



REPORT OF THE CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF THE WATERS OF THE MUSKINGUM RIVER AND ITS TRIBUTARIES.

By E. G. HORTON, B. S.

Chemist and Bacteriologist of the Ohio State Board of Health.

The river selected for the 1899 investigations was the Muskingum, and it includes the following tributaries: Tuscarawas river, Kokosing river, Black and Rocky Forks of Mohican river, Big Stillwater, Wills, Nimishillen, Apple, Killbuck, Licking, and Walhonding creeks. The relation of these tributaries to each other and to the Muskingum proper is shown later.

The plan of the work consisted in the chemical and bacteriological examination of samples taken from selected points, or sampling stations, during each month from April to November, inclusive, *i. e.*, eight samples from each station. There were in all thirty of these stations located at or near fifteen of the larger cities and villages upon the water-shed, and from them two hundred and thirty-eight samples were collected, no collection having been made from Licking creek above Zanesville in April, nor from Black Fork below Shelby in October. For details as to location of the individual stations see page 471.

It was found possible to so arrange the trips that the collector was enabled to make the round in two trips of three days each, reaching Columbus again on the evening of the third day, which gave exactly the same conditions for handling the samples as prevailed last year, since both trips were not made in the same week. Owing to unavoidable difficulties, the April trips were so delayed that the second one came the first week in May, but the collections of that first week in May are spoken of throughout the report as April samples, while the term "May samples" always refers to those taken later in the month.

It is again necessary for us to express regret that the presence or absence of intestinal bacteria in the waters could not have been made a part of the routine work, but as desirable as such a procedure assuredly is, it could not be included, in view of the already heavy work of the laboratory force, without employing additional help, which was a step not permissible with the funds at the disposal of the Board:

METHODS OF EXAMINATION.

With the exception of the manner of determining turbidity and of expressing the amount of dissolved oxygen found, no changes were made from the methods followed last year, and since this report will reach in

the main those persons who have last year's report, the reader is referred for a complete description of methods to the Report of the Ohio State Board of Health for 1898, pages 345 to 353. (Reprint pages 19-26.)

As one of the results of this study of river-waters in Ohio is to show where filtration is necessary, provided that water is to be used for a public supply, and as the suspended matter (which is the cause of the turbidity) is frequently an important factor in filtration, it is desirable that more accurate terms than mere adjectives be employed for recording the turbidities, and thus the readings were made by Hazen's platinum wire method, as follows: A piece of platinum wire .04 of an inch in diameter, (No. 18 American gauge) was inserted in a pine stick so as to form a right angle with the stick. Upon the stick the scale was marked, being the reciprocals of the distances from the wire, e. g., the point one-half inch from the wire was marked 2., one inch from the wire 1., two inches .5., three inches .33, etc., with intervening points similarly determined. The reading was taken at that point on the scale which was at the surface of the water when the wire was just barely visible with the stick held vertically in the water, but not in direct sunlight. In order that it might be placed in the case carried by the collector, the stick was arranged with a joint at the center so it could be folded. When opened out for use, the stick was one yard long, which was sufficient to permit reaching the bottom of the stream in all cases of clear water except a few times above Newark and Canton. The proportion of samples with a turbidity of less than .03 was very small, and moreover, when an open stream has a turbidity lower than that, the water may be called clear.

Our studies upon the waters of flowing streams have brought us to the conclusion that it is entirely improper to express the amount of dissolved oxygen in such waters by a percentage of saturation computed from the tables now in use. We believe the water of some of our streams has an opportunity (e. g. under the influence of certain oxygen producing plants) to contain greater amounts of oxygen than it is possible to make distilled water take up by shaking in contact with a mixture of about one-fifth oxygen and four-fifths nitrogen. For this reason we are no longer stating the dissolved oxygens in percentages of saturation, but give the results in milligrams per litre and record the temperature as usual.

LIST OF SAMPLING STATIONS.

The following list of stations is given to show the designation and location of the points where samples were taken, how the samples were taken, and the body of water from which taken. The method of designation is purely an arbitrary one, and is accomplished by the use of numbers. A station number unaccompanied by a subscript *letter* shows the station was above the pollution of the adjacent village or city, while a number with a subscript letter shows the station to have been situated below local pollution. When more than one sample was taken above any

city or village it is shown by the presence of subscript numerals being attached to the station numbers, e. g., 10—1 is the station above Coshocton on Tuscarawas river, 10—2 above Coshocton on Walhonding creek, and 10a below Coshocton on Muskingum river.

In reference to how the samples were taken, the statement "from the bank," means from the bank, or a few steps from the bank, as the collector carried rubber boots to enable him to step out into the stream, when the samples were always taken with the collector facing up stream. The stations are grouped according to the streams from which samples were taken.

NIMISHILLEN CREEK.

Station 1 was located above Canton at the water works plant of that city on the West Branch of Nimishillen. The samples, except for May and November, were taken from the end of the race, just as the water enters the pumping house. The collections were made from the stone work at the end of the race. On the dates of the May and November collections the race was not in use, and accordingly the samples were taken from the stream itself as it passed through the water works park.

1a. Below Canton, on the Nimishillen proper, and just below the highway bridge, near Shock's mill. The first samples were taken from the west bank, but the later ones from the east side, as the facilities were better there during low water.

TUSCARAWAS RIVER.

2. Above Massillon, some 150 yards above Shorteast street bridge, on the west bank of the river near the railroad crossings.

2a. Below Massillon, from the east bank, at a point just below the cemetery.

3. Above Canal Dover, from the west bank opposite to and just above the American Tin Plate mill.

Owing to the short distance between Canal Dover and New Philadelphia, their pollutions were considered as from one place, and no samples were taken between those villages.

4a. Below New Philadelphia, at a point opposite the C., L. & W. gravel pit. The samples were taken from a row boat or from the roots of a tree on the eastern bank.

10-1. Above Coshocton. The April sample was taken from the south bank, but owing to the difficulty in reaching a suitable spot on that side of the river, subsequent collections were made from the other shore on the Hutchinson farm, opposite the electric light plant. Most of the samples were taken from a projecting log.

BIG STILLWATER CREEK.

5. Above Uhrichsville and Dennison, at the intake furnishing the supply for those villages. Most of the samples were taken at the intake

pier, but it was so muddy there in low stages that the collector made use of a projecting log a few yards up stream.

5a. Below Uhrichsville and Dennison. The collections here were from the muddy shore on the east side of the stream near Scott's coal bank. The mouth of the Little Stillwater is perhaps half a mile above this station.

MOHICAN RIVER.

A. Black Fork.

6. Above Shelby. The samples were taken from a projecting log on the west side of the stream, some twenty yards above the Mickey bridge.

6a. Below Shelby, from the rocks on the eastern shore, near the tenant's house, on the John Dempsey farm.

B. Rocky Fork.

7. Above Mansfield, between the B. & O. and P. Ft. W. & C. R. R. where the pike crosses the stream. These samples were taken just above the bridge, and at an unusual distance above local pollution, since no nearer point was easy of access.

7a. Below Mansfield, from the east bank just below the bridge on Park avenue, East.

APPLE CREEK.

9-1. Above Wooster, from the rocks on the east bank of the stream above the highway bridge on the White farm.

KILLBUCK CREEK.

9-2. Above Wooster, from the west bank of Big Killbuck, nearly opposite the old Eicher salt well, and just below the mouth of Little Killbuck.

9a. Below Wooster, from the west bank near Byerly's sand bank, and some forty rods south of Killbuck covered bridge.

KOKOSING RIVER.

8. Above Mt. Vernon. The April sample was taken where the B. & O. track crosses the river, but the later collections were made from a projecting log on the left bank, about one-half mile nearer the village, and nearly opposite Banning's Island.

8a. Below Mt. Vernon, from the north bank, a short distance below the mouth of Center run.

WALHONDING CREEK.

10-2. Above Coshocton. The April collection was made just above the T., W. V. & O. bridge, but owing to the difficulty of sampling at that point, the station was subsequently located about one-fourth mile above where the creek dips to the Keene road. The samples were taken from a row boat.

WILLS CREEK.

11. Above Cambridge, from the left bank above the C. & M. bridge. The April sample was taken opposite the water works intake, which is but a few yards above the mouth of Leatherwood creek. The flow in Wills creek at this place is an uncertain factor, and to avoid any influence from the back water of Leatherwood, the remainder of the samples were taken a few rods farther up stream.

11a. Below Cambridge, from the rocks on the right bank of the stream just above the Taylor bridge.

LICKING CREEK.

12. Above Newark. The samples were taken from a projecting log on the left bank of the North Fork, just above the covered bridge at the water works.

12a. Below Newark, from the north bank a short distance above the mouth of Quarry Run. The later samples were taken from the roots of a tree, and the earlier ones from the bank.

13-2. Above Zanesville, from a row boat, on the south bank, near the house of Mr. Diehl.

13-3. Above Zanesville, from a row boat in the back water of the dam at the Hook Bro.'s and Aston mill. This station represents the water of the Zanesville ice field.

MUSKINGUM RIVER.

10a. Below Coshocton, from the east side of the river at Jake Henry's ferry. At different times the samples were collected from a log, a boat, or the bank.

13-1. Above Zanesville, from the east bank a few yards above the city water works plant.

13a. Below Zanesville, from rocks at Saw Gum Hollow, on the east side during April and May, but afterwards from a boat on the opposite shore.

14. Above McConnellsville, from a row boat on the east bank near the location of the drilled wells for the new water supply.

15. Above Marietta. The April sample was taken from the west shore, but the remaining collections were made from the rocks on the east side, near the Washington County Childrens' Home.

By reference to the engineer's report, page 708, table 7, it is seen that eight out of the fifteen villages or cities represented in the above list of sampling stations used no creek or river water in their public supplies, while the remaining seven obtained either a portion or all of the supply from such sources. One (Marietta) takes her supplies from the Ohio river, and examinations were made of monthly samples (except in April) taken near the intake pipe, but of course, the results are not in-

cluded among the Muskingum analyses. Three, viz., Canton, Newark, and Wooster draw at times more or less water for their public supplies from Nimishillen, Licking, and Apple creeks, respectively. The reader is referred to the accompanying report of the Engineer of the Board for information concerning the proportion of surface water admitted in the places just named. The remaining three villages and cities (in reality four, since for our work two of them were considered as one from the standpoint of supply and population) Zanesville, Cambridge, Uhrichsville and Dennison, obtained, at the time of this investigation, the water for their supplies from the Muskingum, Wills creek, and Big Stillwater creek respectively.

As a result, the samples from the following stations represent the character of the water which was entering to a greater or less degree into the water works system of the place named:

12-1, Licking creek above Newark; 9-1, Apple creek above Wooster; 1, West Branch of Nimishillen creek above Canton; 11, Wills creek above Cambridge; 5, Big Stillwater above Uhrichsville and Dennison; and 13-1, Muskingum river above Zanesville.

For a better idea of the general location of all the sampling stations, their bearing to each other, and the relation of the several tributaries to the main stream, the reader is referred to the diagrammatic representation of the Muskingum system given on page 524. The relative location of the stations to the adjacent city or village is best shown on the individual map for that city or village.

THE FOLLOWING LIST GIVES THE SAMPLES, BY SERIAL NUMBER, WHERE AND WHEN TAKEN, AND THE DATE THEY WERE RECEIVED IN THE LABORATORY.

1. Marietta, above, Muskingum, April 28th, 1:50 P. M. Received April 29, 4 P. M.
2. McConnellsville, above, Muskingum, April 28, 5 P. M. Received April 29, 4 P. M.
3. Zanesville, above, Muskingum, April 29, 10 A. M. Received April 29, 4 P. M.
4. Zanesville, below, Muskingum, April 29, 11 A. M. Received April 29, 4 P. M.
5. Zanesville, Licking creek, ice field, April 29, 12 noon. Received May 1, 8 A. M.
6. Cambridge, above, Wills creek, April 29, 2:30 P. M. Received May 1, 8 A. M.
7. Cambridge, below, Wills creek, April 29, 3:30 P. M. Received May 1, 8 A. M.
8. Newark, below, Licking, May 3, 9 A. M. Received May 4, 8:30 A. M.

9. Newark, above, Licking, May 3, 9:45 A. M. Received May 4, 8:30 A. M.
10. Mt. Vernon, below, Kokosing, May 3, 12:45 P. M. Received May 4, 8:30 A. M.
11. Mt. Vernon, above, Kokosing, May 3, 1:45 P. M. Received May 4, 8:30 A. M.
12. Shelby, above, Black Fork, May 3, 4:30 P. M. Received May 4, 3:15 P. M.
13. Shelby, below Black Fork, May 3, 5:15 P. M. Received May 4, 3:15 P. M.
14. Mansfield, below, Rocky Fork, May 4, 8 A. M. Received May 5, 9:40 A. M.
15. Mansfield, above, Rocky Fork, May 4, 10 A. M. Received May 5, 9:40 A. M.
16. Wooster, below, Killbuck, May 4, 3:30 P. M. Received May 6, 8:30 A. M.
17. Wooster, above, Killbuck, May 4, 4:30 P. M. Received May 6, 8:30 A. M.
18. Wooster, above, Apple creek, May 4, 5:45 P. M. Received May 6, 8:30 A. M.
19. Massillon, above, Tuscarawas, May 5, 8 A. M. Received May 6, 1 P. M.
20. Massillon, below, Tuscarawas, May 5, 9 A. M. Received May 6, 1 P. M.
21. Canton, above, West Branch Nimishillen, May 5, 10:45 A. M. Received May 6, 1 P. M.
22. Canton, below, Nimishillen, May 5, 12 noon. Received May 6, 1 P. M.
23. Canal Dover, above, Tuscarawas, May 5, 2:45 P. M. Received May 6, 8:30 A. M.
24. New Philadelphia, below, Tuscarawas, May 5, 5 P. M. Received May 8, 8:00 A. M.
25. Uhrichsville and Dennison, below, Big Stillwater, May 6, 10:30 A. M. Received May 8, 11:30 A. M.
26. Uhrichsville and Dennison, above, Big Stillwater, May 6, 9:30 A. M. Received May 8, 11:30 A. M.
27. Coshocton, below, Muskingum, May 6, 1 P. M. Received May 8, 11:30 A. M.
28. Coshocton, above, Walhonding, May 6, 2 P. M. Received May 8, 11:30 A. M.
29. Coshocton, above, Tuscarawas, May 6, 3:30 P. M. Received May 8, 11:30 A. M.
30. Zanesville, above, Licking, May 23, 10:30 A. M. Received May 24, 8:30 A. M.

31. Zanesville, Licking, Icefield, May 23, 11 A. M. Received May 24, 8:30 A. M.
32. Zanesville, below, Muskingum, May 23, 12 noon, Received May 24, 8:30 A. M.
33. Zanesville, above, Muskingum, May 23, 12:40 P. M. Received May 24, 8:30 A. M.
34. McConnellsville, above, Muskingum, May 24, 8 A. M. Received May 25, 8:30 A. M.
35. Marietta, above, Muskingum, May 24, 11:30 A. M. Received May 25, 8:30 A. M.
36. Cambridge, above, Wills creek, May 24, 5:30 P. M. Received May 25, 8:30 A. M.
37. Cambridge, below, Wills creek, May 24, 6:20 P. M. Received May 25, 8:30 A. M.
38. Coshocton, above, Tuscarawas, May 25, 8:30 A. M. Received May 25, 6 P. M.
39. Coshocton, above, Walhonding, May 25, 9:00 A. M. Received May 25, 6 P. M.
40. Coshocton, below, Muskingum, May 25, 9:45 A. M. Received May 25, 6 P. M.
41. Newark, above, Licking, May 25, 2 P. M. Received May 26, 8 A. M.
42. Newark, below, Licking, May 25, 3 P. M. Received May 26, 8 A. M.
43. Mt. Vernon, above, Kokosing, May 29, 10 A. M. Received May 30, 8:30 A. M.
44. Mt. Vernon, below, Kokosing, May 29, 10:45 A. M. Received May 30, 8:30 A. M.
45. Shelby, above, Black Fork, May 29, 2:15 P. M. Received May 31, 11:30 A. M.
46. Shelby, below, Black Fork, May 29, 3:10 P. M. Received May 31, 11:30 A. M.
47. Mansfield, below, Rocky Fork, May 29, 5:20 P. M. Received May 30, 9 A. M.
48. Mansfield, above, Rocky Fork, May 29, 6:40 P. M. Received May 30, 9 A. M.
49. Wooster, above, Apple creek, May 30, 8:30 A. M. Received May 31, 9:30 A. M.
50. Wooster, above, Killbuck, May 30, 9:45 A. M. Received May 31, 9:30 A. M.
51. Wooster, below, Killbuck, May 30, 11 A. M. Received May 31, 9:30 A. M.
52. Canton, above, West Branch Nimishillen, May 30, 2 P. M. Received May 31, 9:30 A. M.

53. Canton, below, Nimishillen, May 30, 2:45 P. M. Received May 31, 9:30 A. M.
54. Massillon, above, Tuscarawas, May 30, 5 P. M. Received June 1, 10:00 A. M.
55. Massillon, below, Tuscarawas, May 30, 6:00 P. M. Received June 1, 10:00 A. M.
56. Canal Dover, above, Tuscarawas, May 31, 9:00 A. M. Received June 1, 8:30 A. M.
57. New Philadelphia, below, Tuscarawas, May 31, 10:30 A. M. Received June 1, 8:30 A. M.
58. Uhrichsville and Dennison, above, Big Stillwater, May 31, 2:00 P. M. Received June 1, 8:30 A. M.
59. Uhrichsville and Dennison, below, Big Stillwater, May 31, 3:00 P. M. Received June 1, 8:30 A. M.
60. Zanesville, below, Muskingum, June 21, 1:00 P. M. Received June 22, 10:30 A. M.
61. Zanesville, above, Muskingum, June 21, 2:00 P. M. Received June 22, 10:30 A. M.
62. Zanesville, above, Licking, June 21, 3:30 P. M. Received June 22, 10:30 A. M.
63. Zanesville, Licking, Icefield, June 21, 2:45 P. M. Received June 22, 10:30 A. M.
64. McConnellsville, above, Muskingum, June 22, 7:00 A. M. Received June 22, 6:00 P. M.
65. Marietta, above, Muskingum, June 22, 1 P. M. Received June 23, 8:30 A. M.
66. Cambridge, above, Wills creek, June 22, 5:30 P. M. Received June 23, 2:30 P. M.
67. Cambridge, below, Wills creek, June 22, 6:30 P. M. Received June 23, 2:30 P. M.
68. Newark, above, Licking, June 23, 9:00 A. M. Received June 23, 2:30 P. M.
69. Newark, below, Licking, June 23, 10:00 A. M. Received June 23, 2:30 P. M.
70. Coshocton, above, Tuscarawas, June 23, 2:20 P. M. Received June 24, 9:00 A. M.
71. Coshocton, above, Walhonding, June 23, 3:00 P. M. Received June 24, 9:00 A. M.
72. Coshocton, below, Muskingum, June 23, 3:45 P. M. Received June 24, 9:00 A. M.
73. Mt. Vernon, below, Kokosing, June 27, 9:45 A. M. Received June 28, 8:30 A. M.
74. Mt. Vernon, above, Kokosing, June 27, 10:45 A. M. Received June 28, 8:30 A. M.

75. Shelby, above, Black Fork, June 27, 2:00 P. M. Received June 28, 3:00 P. M.
76. Shelby, below, Black Fork, June 27, 3:30 P. M. Received June 28, 3:00 P. M.
77. Mansfield, above, Rocky Fork, June 27, 5:00 P. M. Received June 28, 10:00 A. M.
78. Mansfield, below, Rocky Fork, June 27, 6:00 P. M. Received June 28, 10:00 A. M.
79. Wooster, below, Killbuck, June 28, 8:20 A. M. Received June 29, 9:30 A. M.
80. Wooster, above, Killbuck, June 28, 9:40 A. M. Received June 29, 9:30 A. M.
81. Wooster, above, Apple creek, June 28, 11:00 A. M. Received June 29, 9:30 A. M.
82. Canton, below, Nimishillen, June 28, 2:00 P. M. Received June 29, 9:30 A. M.
83. Canton, above, Nimishillen, West Branch, June 28, 3:00 P. M. Received June 29, 9:30 A. M.
84. Massillon, below, Tuscarawas, June 28, 4:45 P. M. Received June 30, 8:30 A. M.
85. Massillon, above, Tuscarawas, June 28, 5:30 P. M. Received June 30, 8:30 A. M.
86. Canal Dover, above, Tuscarawas, June 29, 8:15 A. M. Received June 30, 9:00 A. M.
87. New Philadelphia, below, Tuscarawas, June 29, 9:30 A. M. Received June 30, 9:00 A. M.
88. Uhrichsville and Dennison, below, Big Stillwater, June 29, 12:45 P. M. Received June 30, 9:00 A. M.
89. Uhrichsville and Dennison, above, Big Stillwater, June 29, 2:30 P. M. Received June 30, 9:00 A. M.
90. Mt. Vernon, below, Kokosing, July 18, 9:45 A. M. Received July 19, 8:00 A. M.
91. Mt. Vernon, above, Kokosing, July 18, 10:30 A. M. Received July 19, 8:00 A. M.
92. Shelby, above, Black Fork, July 18, 2:00 P. M. Received July 19, 9:00 A. M.
93. Shelby, below, Black Fork, July 18, 3:00 P. M. Received July 19, 9 A. M.
94. Mansfield, above, Rocky Fork, July 18, 5:15 P. M. Received July 19, 8:00 A. M.
95. Mansfield, below, Rocky Fork, July 18, 6:20 P. M. Received July 19, 8:00 A. M.
96. Wooster, above, Apple creek, July 19, 8:15 A. M. Received July 20, 3:00 P. M.

97. Wooster, below, Killbuck, July 19, 9:15 A. M. Received July 20, 3:00 P. M.
98. Wooster, above, Killbuck, July 19, 10:45 A. M. Received July 20, 3:00 P. M.
99. Massillon, below, Tuscarawas, July 19, 1:45 P. M. Received July 21, 8:00 A. M.
100. Massillon, above, Tuscarawas, July 19, 2:30 P. M. Received July 21, 8:00 A. M.
101. Canton, below, Nimishillen, July 19, 5:00 P. M. Received July 21, 9:30 A. M.
102. Canton, above, Nimishillen, West Branch, July 19, 6:00 P. M. Received July 21, 9:30 A. M.
103. Canal Dover, above, Tuscarawas, July 20, 8:45 A. M. Received July 21, 9:30 A. M.
104. New Philadelphia, below, Tuscarawas, July 20, 9:45 A. M. Received July 21, 9:30 A. M.
105. Uhrichsville and Dennison, below, Big Stillwater, July 20, 12:30 P. M. Received July 22, 9:40 A. M.
106. Uhrichsville and Dennison, above, Big Stillwater, July 20, 2:15 P. M. Received July 22, 9:40 A. M.
107. Coshocton, above, Tuscarawas, July 24, 11:45 A. M. Received July 25, 8:30 A. M.
108. Coshocton, above, Wallhonding, July 24, 12:15 P. M. Received July 25, 8:30 A. M.
109. Coshocton, below, Muskingum, July 24, 12:45 P. M. Received July 25, 8:30 A. M.
110. Cambridge, above, Wills creek, July 24, 5:00 P. M. Received July 25, 1:30 P. M.
111. Cambridge, below, Wills creek, July 24, 5:45 P. M. Received July 25, 1:30 P. M.
112. Marietta, above, Muskingum, July 25, 11:00 A. M. Received July 26, 8:30 A. M.
113. McConnellsville, above, Muskingum, July 25, 5:00 P. M. Received July 26, 2:30 P. M.
114. Newark, below, Licking, July 27, 10:15 A. M. Received July 27, 3:40 P. M.
115. Newark, above, Licking, July 27, 11:15 A. M. Received July 27, 3:40 P. M.
116. Zanesville, above, Licking, July 27, 2:30 P. M. Received July 28, 8:00 A. M.
117. Zanesville, Licking, icefield, July 27, 3:30 P. M. Received July 28, 8:00 A. M.
118. Zanesville, below, Muskingum, July 27, 4:20 P. M. Received July 28, 8:00 A. M.

119. Zanesville, above, Muskingum, July 27, 5:00 P. M. Received July 28, 8:00 A. M.
120. Mt. Vernon, below, Kokosing, August 17, 10:00 A. M. Received August 18, 10:45 A. M.
121. Mt. Vernon, above, Kokosing, August 17, 10:45 A. M. Received August 18, 10:45 A. M.
122. Mansfield, below, Rocky Fork, August 17, 1:30 P. M. Received August 18, 10:45 A. M.
123. Mansfield, above, Rocky Fork, August 17, 2:30 P. M. Received August 18, 10:45 A. M.
124. Shelby, above, Black Fork, August 17, 4:30 P. M. Received August 19, 8:30 A. M.
125. Shelby, below, Black Fork, August 17, 5:30 P. M. Received August 19, 8:30 A. M.
126. Wooster, below, Killbuck, August 18, 8:00 A. M. Received August 21, 8:00 A. M.
127. Wooster, above, Killbuck, August 18, 9:30 A. M. Received August 21, 8:00 A. M.
128. Wooster, above, Apple creek, August 18, 10:30 A. M. Received August 21, 8:00 A. M.
129. Massillon, below, Tuscarawas, August 18, 1:20 P. M. Received August 19, 9:15 A. M.
130. Massillon, above, Tuscarawas, August 18, 2:15 P. M. Received August 19, 9:15 A. M.
131. Canton, below, Nimishillen, August 18, 4:30 P. M. Received August 21, 9:30 A. M.
132. Canton, above, Nimishillen, West Branch, August 18, 5:30 P. M. Received August 21, 9:30 A. M.
133. Uhrichsville and Dennison, above, Big Stillwater, August 19, 1:15 P. M. Received August 21, 8:00 A. M.
134. Uhrichsville and Dennison, below, Big Stillwater, August 19, 2:30 P. M. Received August 21, 8:00 A. M.
135. Canal Dover, above, Tuscarawas, August 21, 2:00 P. M. Received August 22, 8:30 A. M.
136. New Philadelphia, below, Tuscarawas, August 21, 3:00 P. M. Received August 22, 8:30 A. M.
137. Coshocton, below, Muskingum, August 29, 11:15 A. M. Received August 30, 11:00 A. M.
138. Coshocton, above, Walhonding, August 29, 11:50 A. M. Received August 30, 11:00 A. M.
139. Coshocton, above, Tuscarawas, August 29, 12:15 P. M. Received August 30, 11:00 A. M.
140. Cambridge, above, Wills creek, August 29, 4:45 P. M. Received August 30, 6:00 P. M.

141. Cambridge, below, Wills creek, August 29, 6:00 P. M. Received August 30, 6:00 P. M.
142. Marietta, above, Muskingum, August 30, 11:15 A. M. Received August 31, 11:00 A. M.
143. McConnellsville, above, Muskingum, August 30, 5:20 P. M. Received August 31, 4:30 P. M.
144. Zanesville, Licking, icefield, August 31, 8:00 A. M. Received August 31, 4:30 P. M.
145. Zanesville, above, Licking, August 31, 9:00 A. M. Received August 31, 4:30 P. M.
146. Zanesville, below, Muskingum, August 31, 10:30 A. M. Received August 31, 4:30 P. M.
147. Zanesville, above, Muskingum, August 31, 11:15 A. M. Received August 31, 4:30 P. M.
148. Newark, below, Licking, August 31, 3:00 P. M. Received September 1, 8:30 A. M.
149. Newark, above, Licking, August 31, 4:15 P. M. Received September 1, 8:30 A. M.
150. Mt. Vernon, below, Kokosing, September 18, 9:45 A. M. Received September 19, 1:00 P. M.
151. Mt. Vernon, above, Kokosing, September 18, 10:30 A. M. Received September 19, 1:00 P. M.
152. Mansfield, below, Rocky Fork, September 18, 1:30 P. M. Received September 20, 11:15 A. M.
153. Mansfield, above, Rocky Fork, September 18, 2:30 P. M. Received September 20, 11:15 A. M.
154. Shelby, above, Black Fork, September 18, 4:30 P. M. Received September 19, 2:45 P. M.
155. Shelby, below, Black Fork, September 18, 5:30 P. M. Received September 19, 2:45 P. M.
156. Wooster, below, Killbuck, September 19, 8:00 A. M. Received September 20, 11:15 A. M.
157. Wooster, above, Killbuck, September 19, 9:15 A. M. Received September 20, 11:15 A. M.
158. Wooster, above, Apple creek, September 19, 10:30 A. M. Received September 20, 11:15 A. M.
159. Massillon, below, Tuscarawas, September 19, 1:45 P. M. Received September 20, 11:15 A. M.
160. Massillon, above, Tuscarawas, September 19, 2:30 P. M. Received September 20, 11:15 A. M.
161. Canton, below, Nimishillen, September 19, 5:00 P. M. Received September 21, 10:30 A. M.
162. Canton, above, Nimishillen, West Branch, September 19, 5:45 P. M. Received September 21, 10:30 A. M.

163. Canal Dover, above, Tuscarawas, September 20, 8:00 A. M.
Received September 21, 8:30 A. M.

164. New Philadelphia, below, Tuscarawas, September 20, 9:00 A. M.
Received September 21, 8:30 A. M.

165. Uhrichsville and Dennison, below, Big Stillwater, September 20, 11:15 A. M. Received September 21, 8:30 A. M.

166. Uhrichsville and Dennison, above, Big Stillwater, September 20, 1:15 P. M. Received September 21, 8:30 A. M.

167. Coshocton, above, Tuscarawas, September 26, 12 noon. Received September 27, 11:30 A. M.

168. Coshocton, above, Walhonding, September 26, 12:30 P. M.
Received September 27, 11:30 A. M.

169. Coshocton, below, Muskingum, September 26, 1:15 P. M. Received September 27, 11:30 A. M.

170. Cambridge, above, Wills creek, September 26, 4:45 P. M.
Received September 27, 4:30 P. M.

171. Cambridge, below, Wills creek, September 26, 5:30 P. M.
Received September 27, 4:30 P. M.

172. Marietta, above, Muskingum, September 27, 11:10 A. M. Received September 28, 8:30 P. M.

173. McConnellsville, above, Muskingum, September 27, 5:00 P. M. Received September 29, 8:00 A. M.

174. Zanesville, Licking, icefield, September 28, 7:30 A. M. Received September 29, 8:00 A. M.

175. Zanesville, above, Licking, September 28, 8:15 A. M. Received September 29, 8:00 A. M.

176. Zanesville, below, Muskingum, September 28, 9:45 A. M. Received September 29, 8:00 A. M.

177. Zanesville, above, Muskingum, September 28, 11:00 A. M. Received September 29, 8:00 A. M.

178. Newark, above, Licking, September 28, 3:00 P. M. Received September 29, 8:00 A. M.

179. Newark, below, Licking, September 28, 4:00 P. M. Received September 29, 8:00 A. M.

180. Newark, below, Licking, October 10, 8:30 A. M. Received October 10, 1:00 P. M.

181. Newark, above, Licking, October 10, 9:15 A. M. Received October 10, 1:00 P. M.

182. Coshocton, above, Walhonding, October 10, 11:30 A. M. Received October 11, 11:45 A. M.

183. Coshocton, above, Tuscarawas, October 10, 12:15 P. M. Received October 11, 11:45 A. M.

184. Coshocton, below, Muskingum, October 10, 1:00 P. M. Received October 11, 11:45 A. M.

185. Uhrichsville and Dennison, below, Big Stillwater, October 10, 3:30 P. M. Received October 12, 11:15 A. M.
186. Uhrichsville and Dennison, above, Big Stillwater, October 10, 4:15 P. M. Received October 12, 11:15 A. M.
187. New Philadelphia, below, Tuscarawas, October 11, 8:00 A. M. Received October 12, 11:15 A. M.
188. Canal Dover, above, Tuscarawas, October 11, 9:15 A. M. Received October 12, 11:15 A. M.
189. Canton, below, Nimishillen, October 11, 1:15 P. M. Received October 12, 11:30 A. M.
190. Canton, above, Nimishillen, West Branch, October 11, 2:00 P. M. Received October 12, 11:30 A. M.
191. Massillon, above, Tuscarawas, October 11, 4:00 P. M. Received October 13, 11:00 A. M.
192. Massillon, below, Tuscarawas, October 12, 7:45 A. M. Received October 13, 11:00 A. M.
193. Wooster, below, Killbuck, October 12, 7:45 A. M. Received October 13, 8:30 A. M.
194. Wooster, above, Killbuck, October 12, 8:45 A. M. Received October 13, 8:30 A. M.
195. Wooster, above, Apple creek, October 12, 10:15 A. M. Received October 13, 8:30 A. M.
196. Mansfield, below, Rocky Fork, October 12, 1:45 P. M. Received October 13, 11:00 A. M.
197. Mansfield, above, Rocky Fork, October 12, 2:45 P. M. Received October 13, 11:00 A. M.
198. Shelby, above, Black Fork, October 12, 4:15 P. M. Received October 13, 11:00 A. M.
199. Mt. Vernon, below, Kokosing, October 16, 9:45 A. M. Received October 17, 8:00 A. M.
200. Mt. Vernon, above, Kokosing, October 16, 10:45 A. M. Received October 17, 8:00 A. M.
201. Cambridge, above, Wills creek, October 16, 3:00 P. M. Received October 17, 8:00 A. M.
202. Cambridge, below, Wills creek, October 16, 4:15 P. M. Received October 17, 8:00 A. M.
203. Marietta, above, Muskingum, October 17, 1:30 P. M. Received October 18, 8:00 A. M.
204. McConnellsville, above, Muskingum, October 17, 5:00 P. M. Received October 18, 1:30 P. M.
205. Zanesville, above, Muskingum, October 18, 7:15 A. M. Received October 18, 1:30 P. M.
206. Zanesville, below, Muskingum, October 18, 8:00 A. M. Received October 18, 1:30 P. M.

207. Zanesville, Licking, icefield, October 18, 8:30 A. M. Received October 18, 4:00 P. M.

208. Zanesville, above, Licking, October 18, 9:30 A. M. Received October 18, 4:00 P. M.

209. Newark, below, Licking, November 14, 8:30 A. M. Received November 15, 8:00 A. M.

210. Newark, above, Licking, November 14, 9:30 A. M. Received November 15, 8:00 A. M.

211. Coshocton, above, Walhonding, November 14, 11:30 A. M. Received November 15, 11:00 A. M.

212. Coshocton, above, Tuscarawas, November 14, 12:15 P. M. Received November 15, 11:00 A. M.

213. Coshocton, below, Muskingum, November 14, 1:00 P. M. Received November 15, 11:00 A. M.

214. Uhrichsville and Dennison, above, Big Stillwater, November 14, 3:30 P. M. Received November 16, 8:00 A. M.

215. Uhrichsville and Dennison, below, Big Stillwater, November 14, 4:30 P. M. Received November 16, 8:00 A. M.

216. New Philadelphia, below, Tuscarawas, November 15, 8:00 A. M. Received November 16, 11:30 A. M.

217. Canal Dover, above, Tuscarawas, November 15, 10:00 A. M. Received November 16, 11:30 A. M.

218. Massillon, below, Tuscarawas, November 15, 4:30 P. M. Received November 17, 9:00 A. M.

219. Massillon, above, Tuscarawas, November 15, 5:30 P. M. Received November 17, 9:00 A. M.

220. Canton, below, Nimishillen, November 16, 7:45 A. M. Received November 17, 10:00 A. M.

221. Canton, above, Nimishillen, West Branch, November 16, 8:45 A. M. Received November 17, 10:00 A. M.

222. Wooster, above, Apple creek, November 16, 1:00 P. M. Received November 17, 10:00 A. M.

223. Wooster, below, Killbuck, November 16, 1:45 P. M. Received November 17, 10:00 A. M.

224. Wooster, above, Killbuck, November 16, 3:45 P. M. Received November 18, 8:15 A. M.

225. Mansfield, below, Rocky Fork, November 17, 8:00 A. M. Received November 17, 4:00 P. M.

226. Mansfield, above, Rocky Fork, November 17, 9:00 A. M. Received November 17, 4:00 P. M.

227. Shelby, above, Black Fork, November 17, 11:15 A. M. Received November 18, 10:45 A. M.

228. Shelby, below, Black Fork, November 17, 1:00 P. M. Received November 18, 10:45 A. M.

229. Mt. Vernon, below, Kokosing, Nov. 21, 9:45 A. M. Received November 22, 4:30 P. M.
230. Mt. Vernon, above, Kokosing, November 21, 10:30 A. M. Received November 22, 4:30 P. M.
231. Cambridge, above, Wills creek, November 21, 2:30 P. M. Received November 22, 4:30 P. M.
232. Cambridge, below, Wills creek, November 21, 4:00 P. M. Received November 22, 4:30 P. M.
233. Marietta, above, Muskingum, November 22, 1:40 P. M. Received November 23, 8:00 A. M.
234. McConnellsville, above, Muskingum, November 22, 5:00 P. M. Received November 23, 5:00 P. M.
235. Zanesville, above, Muskingum, November 23, 8:00 A. M. Received November 23, 5:00 P. M.
236. Zanesville, below, Muskingum, November 23, 9:00 A. M. Received November 23, 5:00 P. M.
237. Zanesville, Licking, icefield, November 23, 9:30 A. M. Received November 24, 8:00 A. M.
238. Zanesville, above, Licking, November 23, 10:30 A. M. Received November 24, 8:00 A. M.

RAINFALL TABLE OF MUSKINGUM WATERSHED.

DAYS ON WHICH ONE-TENTH INCH OR MORE RAINFALL OCCURRED.

I. WALHONDING BASIN.

Station.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Rain.
Ashland	7	4	1	6	4	6	9	3	.32
"	12	16	7	7	5	7	17	4	.10
"	19	27	8	13	26	8	28	14	.75
"	.....	29	9	14	.....	18	29	23	.37
"	.....	31	14	15	.....	24	.....	.....	.....
"	.....	.....	20	17	.....	.....	.....	.....	.....
"	.....	.....	28	25	.....	.....	.....	.....	.....
"	.....	.....	.....	29	.....	.....	.....	.....	.....
Total monthly rainfall.....	.....	4.50	.....	.....	3.92	1.13	.....	2.63	1.71
Departure from the normal at the station.....	.....	-0.04	.....	0.00	+0.84	-2.14	.....	+0.64	-1.47
Shenandoah	7	4	1	5	3	1	8	3	.49
"	8	16	6	6	5	6	11	14	.62
"	12	17	7	7	.....	7	22	23	.50
"	19	27	8	8	.....	8	28	.....	.....
"	24	28	9	13	.....	18	29	.....	.....
"	.....	29	19	15	.....	19	.....	.....	.....
"	.....	31	28	17	.....	25	.....	.....	.....
"	.....	.....	.....	25	.....	26	.....	.....	.....
"	.....	.....	.....	29	.....	28	.....	.....	.....
"
Total monthly rainfall.....	.....	4.13	.....	4.01	3.63	.53	.....	2.11	1.74
Departure from the normal at the station.....	.....	.....	.....	+0.44	+0.29	-2.21	.....	+0.06	-1.62

I. WALHONDING BASIN — Continued.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Mansfield	6	.20	3	.30	1	.40	6	.70	4	.40	6	.90	9	.25	4	.70
"	3	.20	10	.60	5	.35	7	.90	6	.60	9	.40	15	.40	14	.50
"	7	.16	17	.80	7	.42	10	.95	6	.95	9	.70	20	.80	15	.20
"	8	.40	18	1.80	8	.25	12	.40	4	.40	10	.60	24	.20	22	.60
"	13	.40	27	.40	9	.60	13	.40	4	.40	11	.40	28	.40	24	.60
"	19	.30	28	.70	15	.20	15	.45	4	.45	19	.40	29	1.20	24	.60
"	20	.20	30	.20	20	4.10	16	.95	9	.20	20	.30	30	.....	.....	.....
"	20	.20	29	.10	20	.10	20	.80	20	.20	25	.80	30	.....	.....	.....
"	24	.....	.....	.....	.....	.....	24	.30	20	.30	26	.....	.....	.....	.....	.....
"	27	.....	.....	.....	.....	.....	27	.....	10	.10	.....	.....	.....	.....	.....	.....
Total monthly rainfall.....	.....	1.75	.....	4.60	.....	6.42	.....	.....	4.75	.....	1.60	.....	4.55	.....	3.20	2.40
Departure from the normal at the station.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bangorville	7	.38	4	.25	1	.67	5	.12	2	.47	5	.38	8	.12	3	.67
"	8	.20	7	.22	5	.10	7	.97	3	.61	8	.14	9	.14	13	.80
"	12	.25	11	.11	6	.28	8	.21	4	1.03	11	.15	17	.42	22	.30
"	19	.18	12	.18	14	1.53	13	1.13	5	.78	18	.66	28	1.57	.....	.....
"	.....	.....	16	.22	19	3.19	15	.62	.....	.62	25	1.29	29	.34	.....	.....
"	.....	.....	17	1.33	24	.11	16	.67	.....	.67	26	.52	.....	.....	.....	.....
"	.....	.....	27	.72	28	.45	19	.15	.....	.15	28	.10	.....	.....	.....	.....
"	.....	.....	28	.64	.....	.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....
"	.....	.....	29	.30	.....	.....	28	.17	.....	.17	.....	.....	.....	.....	.....	.....
"	.....	.....	31	.37	.....	.....	29	.....	.....	.68	.....	.....	.....	.....	.....	.....
Total monthly rainfall.....	.....	1.01	.....	4.38	.....	6.33	.....	2.43	.....	5.45	.....	3.24	.....	2.59	.....	1.98
Departure from the normal at the station.....	.....	-1.97	.....	-0.03	.....	+2.13	.....	-0.56	.....	+1.88	.....	+0.75	.....	+0.60	.....	-1.70

I. WALHONDING BASIN—Continued.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Levering	7	.46	4	.22	1	.57	5	.77	4	1.84	3	.11	11	.12	3	.62
"	12	.47	7	.21	2	.21	7	.52	5	2.13	5	.37	17	.43	14	.50
"	25	.15	6	.10	6	.28	8	1.13	...	...	7	.12	28	1.00	15	.34
"	...	...	7	.35	7	.16	13	.46	...	...	18	.70	29	.82	23	.34
"	...	...	16	1.10	14	.30	14	.60	...	...	19	.76	...	...	30	.32
"	...	...	17	.77	20	3.55	15	.67	...	...	25	1.35	...	...	...	...
"	...	...	27	1.57	24	.10	16	1.12	...	...	26	.41	...	...	...	...
"	...	...	29	...	...	...	25	.88	...	...	...	...	...	...	...	...
"	...	...	...	...	...	...	29	...	...	...	...	...	...	...	...	...
Total monthly rainfall.	...	1.08	...	4.45	...	6.05	...	6.45	...	3.97	...	3.22	...	2.37	...	2.19
Departure from the normal at the station	...	-3.01	...	+0.52	...	+2.41	...	+2.05	...	+0.96	...	+0.77	...	+0.84	...	-1.82
Wooster	7	.50	4	.39	1	.25	7	.38	4	.13	1	.74	17	.60	3	.55
"	12	.32	17	1.40	7	.59	8	.52	5	.35	6	.22	28	1.03	14	.62
"	19	.12	8	1.17	8	.41	13	.40	...	...	7	1.25	29	.36	23	.24
"	25	.20	27	.83	15	.15	15	.69	...	...	8	.60	...	...	...	...
"	...	...	29	.33	20	.24	16	.35	...	...	18	.17	...	...	...	...
"	...	...	31	...	28	.12	25	1.05	...	...	19	.96	...	...	...	...
"	...	...	...	...	...	...	29	.18	...	...	25	1.00	...	...	...	...
"	...	...	...	...	...	...	...	...	...	...	26	.27	...	...	...	...
"	...	...	...	...	...	...	...	...	...	...	29	.17	...	...	...	...
"
Total monthly rainfall.	...	1.28	...	4.42	...	1.95	...	3.73	...	0.53	...	5.56	...	2.21	...	1.59
Departure from the normal at the station	...	-1.10	...	+0.16	...	-2.09	...	-0.20	...	-1.91	...	+2.51	...	-0.14	...	-1.64

I. WALHONDING BASIN — Continued.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Big Prairie	7	1.27	4	.30	1	.45	7	.60	4	.41	6	.40	8	.25	3	.12
"	12	.35	8	.16	5	.14	13	.92	5	.30	7	.46	11	.10	4	.16
"	24	.40	12	.10	7	.70	15	1.00			8	.42	17	.81	15	.40
"	25	.10	16	.69	8	.20	16	.33			19	1.00	28	1.10	23	.45
"			17	1.20	20	1.43	25	.91			26	1.20				
"			18	.34	27	.20										
"			27	.85												
"			29	.20												
Total monthly rainfall.....		2.17		3.84		3.20		3.79		.80		3.48		2.26		1.24
Departure from the normal at the station		—0.34		—0.07		+0.47		—0.70		—2.50		+0.73		+0.01		—1.87
Killbuck	7	.42	8	.28	1	.34	7	.27	4	.68			9	.15	3	.25
"	17	.24	11	.20	14	.22	8	.33	5	.14			11	.10	14	.47
"	19	.28	17	1.50	15	.40	13	.36					17	.50	23	.50
"	26	.20	18	.30	20	1.35	14	.18					18	.13		
"			27	.55	25	.40	15	.45					28	.57		
"			29	1.66			16	.29					29	.36		
"			31	.11			25	.60								
"							29	.63								
Total monthly rainfall.....		1.35		4.74		2.82		3.20		0.82		3.23		1.81		1.25
Departure from the normal at the station		—2.42		+1.11		—0.10		—1.48		—1.88		+0.29		+0.03		—1.98

I. WALHONDING BASIN—Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Warsaw	7	.66	5	.35	1	.14	7	.40	4	2.29	1	.75	8	.12	3	.28
"	19	.16	8	.13	6	.22	8	.51	5	.24	3	.50	11	.15	14	.32
"	24	.20	12	.23	8	.11	13	.25	26	1.53	7	.12	17	.55	23	.43
"			13	.25	14	.32	15	.50			19	1.00	28	.67		
"			17	.71	15	.26	16	.58			25	.78	29	.24		
"			20	.27	20	1.27	19	.21			29	.38				
"			28	2.74	24	.79	25	1.08								
"			30	.23			28	.15								
"							29	.38								
Total monthly rainfall.....		1.22		6.17		3.44		4.27		4.08		3.58		1.76		1.26
Departure from the normal at the station.....										+1.54		+1.13		—0.13		—2.01

II. LICKING BASIN.

Milfordton	7	.36	5	.20	1	.17	6	.10	2	.24	5	.10	10	.27	3	.10
"	12	.39	8	.33	6	.23	7	.30	4	.76	19	1.03	17	.80	14	.67
"	19	.20	12	.22	14	.48	8	.60	5	.45	24	.98	18	.20	15	.15
"	26	.23	16	.20	15	.31	13	.50			25	.26	28	.90	23	.42
"			17	.33	19	.16	14	.14			26	.10	29	.27		
"			18	.77	20	.94	15	.52								
"			27	.41	24	.16	16	1.02								
"			28	.32			25	.48								
"			29	.80			28	.15								
Total monthly rainfall.....		1.25		3.74		2.55		3.87		1.45		2.54		2.44		1.37
Departure from the normal at the station.....		—2.37		+0.62		—1.04		+0.19		—0.79		—0.15		+0.68		—1.79

II. LICKING BASIN — Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Granville	7	.17	5	.22	1	.30	8	.90	2	.68	11	.10	8	.15	3	.95
"	8	.51	8	.43	2	.24	14	.72	4	.11	19	1.35	17	.50	14	.27
"	12	.18	11	.14	6	.57	16	.64	5	.63	25	.56	28	1.18	21	.12
"	16	.12	13	.77	7	.54	17	.84	6	.53	26	.40	...	...	22	.42
"	19	.27	18	.11	14	.15	26	.73	...	...	29	.16	...	...	23	.11
"	25	.13	27	.13	15	.72	29	.22	...	...	...	...	...	...	...	...
"	26	.90	29	.55	20	.83	30	1.30	...	...	...	...	...	...	...	...
"	29	.12	30	.79	21	.72	...	...	...	...	...	...	...	...	...	...
"	...	...	...	...	25	.34	...	...	...	...	...	...	...	...	...	...
Total monthly rainfall.	...	2.44	...	3.15	...	4.72	...	5.47	...	1.95	...	2.62	...	1.94	...	1.99
Departure from the normal at the station	...	-0.46	...	-0.77	...	+0.93	...	+2.29	...	-0.12	...	-0.78	...	-0.18	...	-1.79
Pataskala	7	.60	4	.12	1	.10	4	.32	2	.24	3	.15	8	.32	3	.80
"	12	.11	7	.70	5	.10	7	.35	5	.29	5	.19	9	.18	14	.21
"	15	.14	8	.36	9	.21	8	.16	31	.53	19	.20	11	.12	23	.51
"	19	.40	11	.24	14	.71	13	.65	...	...	19	.61	17	.55	...	...
"	25	.41	12	.54	19	.25	14	.11	...	...	25	.85	28	1.02	...	...
"	28	.41	13	.10	20	5.58	15	1.39	...	...	26	.14	29	.25	...	...
"	...	...	27	.11	24	.25	16	.37	...	...	...	...	...	...	...	...
"	...	...	28	.12	25	.21	17	.29	...	...	...	...	...	...	...	...
"	...	...	29	.46	...	...	25	.46	...	...	...	...	...	...	...	...
"	...	...	31	.50	...	...	28	.47	...	...	...	...	...	...	...	...
"	...	...	...	...	...	...	30	.18	...	...	...	...	...	...	...	...
Total monthly rainfall.	...	2.15	...	3.40	...	7.68	...	4.83	...	1.16	...	2.43	...	2.44	...	1.68
Departure from the normal at the station	...	-1.89	...	+0.10	...	+3.92	...	+0.56	...	-2.20	...	-0.58	...	+0.55	...	-2.12

III. WILLS CREEK BASIN.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Cambridge	7	.64	10	.40	1	.16	6	.37	2	.46	3	.35	8	.50	3	.45
"	8	.17	11	.25	6	1.30	8	.37	4	.59	5	.17	17	.40	11	.22
"	16	.20	13	.75	9	.80	13	.45			7	.15	29	1.00	15	.25
"	28	.35	16	.10	20	.45	15	.64			11	.45	31	.24	19	.15
"			17	.40	21	.77	16	1.21			19	.46			23	.37
"			20	.48	24	.21	17	.43			20	.12				
"			27	.84	25	.84	25	.67			25	.71				
"			29	1.50	25	.35	29	.15			26	.19				
"			31	.60	28		30	.33								
"																
Total monthly rainfall.....		1.36	....	4.55	....	4.76	....	4.66	....	1.05	....	2.60	....	2.21	....	1.44
Departure from the normal at the station.....		-2.11	....	+1.02	....	+1.43	....	-1.95	....	-1.75	....	+0.52	....	+0.03	....	-1.65

IV. TUSCARAWAS BASIN.

Rittman	7	.38	1	.10	1	.35	7	.40	4	.26	6	.70	17	.73	3	.93
"	12	.25	4	.24	8	.33	8	1.26	5	2.16	8	.20	28	1.35	4	.15
"	19	.80	5	.14	9	.10	13	.22			18	1.40	29	.25	11	.11
"	24	.34	16	.84	19	.18	15	.57			25	1.62			14	.50
"			17	.54			16	.44			26	.15			23	.40
"			18	.62			17	.11			28	.47				
"			27	.82			25	1.55								
"			28	.31			29	1.02								
"			29	.64												
"			30	.40												
"			31	.24												
"																
Total monthly rainfall.....		1.80	....	5.01	....	1.04	....	5.57	....	2.42	....	4.66	....	2.36	....	2.14
Departure from the normal at the station.....		-0.72	....	+1.31	....	-1.87	....	+1.18	....	-0.71	....	+2.02	....	-0.12	....	-1.17

IV. TUSCARAWAS BASIN — Continued.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
New Berlin	7	.56	1	.40	1	.26	6	.18	4	.15	1	.25	8	.18	3	.65
"	12	.34	2	.28	6	.50	7	.50	5	.95	7	.31	17	.90	14	.48
"	25	1.05	5	.22	7	.20	13	.22	10	.35	19	1.43	28	.76	15	.12
"			8	.30	8	.20	15	.48			26	.92	29	.27	23	.20
"			17	1.98	9	.52	16	.97			26	.10				
"			18	.15	15	.28	17	.13			29	.25				
"			27	1.30	19	.15	19	.10								
"			29	1.67	24	.22	25	.55								
"			31	.20	28	.16	28	.24								
Total monthly rainfall.....		2.13	....	6.71	....	2.61	....	3.45	....	1.49	....	3.26	....	2.22	....	1.54
Departure from the normal at the station		-0.87	....	+3.43	....	.....	....	-1.42	....	-1.69	....	-0.75	....	+0.31	....	-1.15
Canton	7	.11	2	.10	1	.28	8	1.69	5	.23	2	.14	9	.20	1	.30
"	8	.58	5	.18	2	.23	14	.22	11	.44	4	.13	18	.77	3	.40
"	12	.51	8	.14	8	.14	16	.88	27	.37	6	.12	29	.83	4	.26
"	25	.98	13	.12	9	.27	17	.38			11	.11			11	.10
"	26	1.74	17	1.86	15	.23	26	.83			19	1.23			12	.11
"	29	.38	18	.62	16	.13	30	.53			20	.13			14	.34
"			27	.34	20	1.18					25	.44			15	.26
"			28	.54	25	.23					26	.58			23	.18
"			29	.47	....	....					29	.24			24	.13
"			30	1.04	....	....					....	....			....	....
Total monthly rainfall.....		4.45	....	5.52	....	2.85	....	4.69	....	1.14	....	3.26	....	1.83	....	2.14
Departure from the normal at the station		+1.63	....	+1.19	....	-1.43	....	-0.06	....	-1.46	....	+0.24	....	-0.58	....	-0.46

IV. TUSCARAWAS BASIN — Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Canal Dover	7	.13	5	.47	1	1.10	6	.10	4	.60	7	.25	17	.60	2	.50
"	8	.60	7	.10	7	.18	7	.66	5	.20	8	.17	29	.82	11	.25
"	12	.40	11	.10	8	.26	13	.60	26	.48	10	.48	31	.15	14	.44
"	24	.11	12	.51	14	.40	15	.75	...	...	18	.85	...	...	18	.11
"	28	.70	16	.56	19	.12	16	.30	...	...	19	.60	...	...	23	.54
"	...	...	17	1.91	24	.66	25	.90	...	...	25	.35	...	...	...	...
"	...	...	26	.24	...	...	29	.17	...	...	26	.55	...	...	...	...
"	...	...	27	.32	...	...	...	...	...	...	29	.30	...	...	...	...
"	...	...	28	1.14	...	...	...	...	...	...	...	...	...	...	...	...
"	...	...	29	1.04	...	...	...	...	...	...	...	...	...	...	...	...
"	...	...	31	.37	...	...	...	...	...	...	...	...	...	...	...	...
Total monthly rainfall.....	...	2.17	...	6.84	...	2.89	...	3.53	...	1.28	...	3.61	...	1.65	...	1.90
Departure from the normal at the station	...	-0.69	...	+3.26	...	-0.41	...	-1.83	...	-0.94	...	+1.26	...	-0.24	...	-1.92
Carrollton	7	.48	5	.46	1	.14	6	.37	4	.33	...	...	...	...	...	...
"	8	.24	11	.20	6	.42	8	.50	5	.22	...	...	...	...	...	...
"	11	.25	16	1.31	7	.83	13	.27	9	.11	...	...	...	...	...	...
"	25	1.20	17	.78	8	.77	15	.31	26	.40	...	...	...	...	...	...
"	29	.44	18	.53	13	.18	16	.48	...	...	...	...	...	...	...	...
"	...	...	27	.90	15	.11	17	.45	...	...	...	...	...	...	...	...
"	...	...	29	1.23	20	.12	19	.43	...	...	...	...	...	...	...	...
"	...	...	31	.43	24	1.12	26	1.15	...	...	...	...	...	...	...	...
"	...	...	...	...	28	.23	28	.12	...	...	...	...	...	...	...	...
Total monthly rainfall.....	...	2.69	...	5.92	...	3.92	...	4.15	...	1.06	...	...	...	...	...	...
Departure from the normal at the station	...	-0.59	...	+2.38	...	+0.83	...	-0.85	...	-1.96	...	...	...	...	...	...

V. MUSKINGUM BASIN — Continued.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Zanesville	7	.17	5	.24	1	.23	8	.22	3	.13	4	.11	9	.18	1	.17
"	8	.57	8	.44	2	.20	14	.76	5	.84	6	.51	18	.47	3	.19
"	19	.13	11	.18	5	.27	16	.57	6	.13	9	.59	29	1.06	4	.15
"			13	.85	6	.39	17	.80	27	1.25	11	.22			12	.16
"			30	.91	7	.12	18	.46			19	.20			14	.15
"					9	.13	26	.66			20	.45			19	.13
"					10	.22	29	.13			25	.28			23	.41
"					20	1.13	30	.83			26	.64				
"					21	1.09					29	.53				
"					25	1.00										
Total monthly rainfall.		1.08		2.86		4.92		4.55		2.45		3.26		1.78		1.43
Departure from the normal at the station																
Milligan	7	.60	5	.41	1	.30	6	.35	2	1.55	4	.40	8	.10	3	.50
"	8	.20	7	.22	9	.48	8	.60	4	.20	9	.75	17	.30	11	.19
"	19	.40	11	.50	10	.30	13	1.90	5	.55	11	.98	18	.16	19	.35
"	25	.45	12	.10	14	.40	15	.10			19	.90	28	1.00	22	.20
"			13	.60	19	.63	16	.75			25	.48	29	.19	23	.20
"			29	1.20	20	1.50	17	.35			26	.46	31	.15		
"			31	.60	24	.40	26	.22			29	.30				
"					25	.97	29	.18								
"							30	.30								
Total monthly rainfall.		1.65		3.62		4.98		4.83		2.40		4.37		2.02		1.49
Departure from the normal at the station		-1.18		+0.52		+1.59		-0.43		-0.44		+1.72		-0.38		-1.65

V. MUSKINGUM BASIN — Continued.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Philo	7	.65	5	.27	1	.20	6	.20	2	.16	4	.81	8	.10	6	.38
"	8	.20	7	.16	5	.18	8	.32	3	.25	7	.31	9	.56	11	.14
" .....	.....	.....	8	.34	9	.53	13	.30	4	.26	9	.34	17	.19	15	.26
" .....	.....	.....	11	.21	10	.26	15	.15	5	.35	11	.32	18	.30	22	.13
" .....	.....	.....	13	.75	13	.25	16	.73	26	.26	19	.64	28	1.15	23	.20
" .....	.....	.....	17	1.07	20	2.05	17	.65	.....	.....	25	.60	31	.14	.....	.....
" .....	.....	.....	27	.10	24	.66	19	.21	.....	.....	26	.95	.....	.....	.....	.....
" .....	.....	.....	29	1.02	25	.78	25	1.28	.....	.....	29	.35	.....	.....	.....	.....
" .....	.....	.....	31	.45	28	.10	30	.61	.....	.....	.....	.....	.....	.....	.....	.....
Total monthly rainfall.....	.....	0.96	.....	4.45	.....	5.08	.....	4.71	.....	1.39	.....	4.37	.....	2.40	.....	1.10
Departure from the normal at the station	.....	.....	.....	.....	.....	+1.30	.....	-1.09	.....	-1.79	.....	+1.52	.....	+0.60	.....	-1.23
McConnelsville	1	.39	5	.36	6	.40	8	.10	2	.99	5	.38	8	.17	3	.47
"	8	1.01	7	.75	8	.14	13	1.64	3	.46	7	.56	17	.19	14	.10
"	29	.11	8	.17	9	.57	15	.36	5	.14	8	1.77	28	.82	15	.16
" .....	.....	.....	11	.21	19	.47	16	.84	21	.11	10	.31	31	.19	18	.10
" .....	.....	.....	12	.56	20	.41	17	.89	.....	.....	19	1.04	.....	.....	19	.38
" .....	.....	.....	16	.26	24	.76	25	.20	.....	.....	25	1.21	.....	.....	23	.35
" .....	.....	.....	29	.59	25	.28	29	.71	.....	.....	29	.43	.....	.....	.....	.....
" .....	.....	.....	31	1.15	28	.21	30	.50	.....	.....	.....	.....	.....	.....	.....	.....
Total monthly rainfall.....	.....	1.64	.....	4.18	.....	3.43	.....	5.60	.....	1.75	.....	5.85	.....	1.41	.....	1.58
Departure from the normal at the station	.....	-1.35	.....	+0.59	.....	-1.01	.....	+0.39	.....	-1.79	.....	+2.87	.....	-0.84	.....	-1.80

V. MUSKINGUM BASIN — Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	Sept.	Rain.	Oct.	Rain.	Nov.	Rain.
Marietta	7	1.00	5	.35	1	1.09	6	.14	2	.30	7	.25	8	.24	1	.25
"	8	.23	7	.32	6	.80	8	.34	3	.47	8	.66	18	.24	3	.28
"			8	.40	9	.53	13	.55	4	.30	9	.92	28	.15	11	.35
"			11	.22	10	.73	13	.15	11	.87	11	1.53	29	.48	19	.75
"			12	.11	15	.85	16	.76	28	.17	19	.27	31	.65	22	.23
"			13	.33	20	.35	17	.75			20	.35			23	.14
"			16	.12	21	.18	26	.18			26	.15				
"			17	.22	24	.95	30	2.46			29	.63				
"			29	1.04	25	.28										
"			31	1.04												
Total monthly rainfall		1.36		4.15		5.82		5.36		2.15		4.76		1.80		2.03
Departure from the normal at the station		-1.78		+0.43		+1.82		0.00		-1.44		+1.94		-0.69		-1.02
Aver. monthly rainfall for the watershed.		1.62		4.74		4.05		4.49		1.66		3.70		2.14		1.66
Departure from the normal for the watershed		-1.39		+0.78		+0.48		+0.04		-1.25		+0.86		+0.04		-1.59

RAINFALL INFLUENCES.

In order to understand the analytical results it is frequently necessary to take into consideration the time and amount of recent rains, since the presence or absence of surface washings is dependent to a marked degree on weather conditions. To this end the preceding rainfall table has been compiled from the monthly reports of the U. S. Weather Bureau. Our thanks are due Mr. J. Warren Smith, Director of the Ohio Section, through whose kindness the data was available.

The table includes the date and the amount of rainfall (when there was a precipitation of one-tenth inch or more) for all observation stations of the Bureau located upon the area drained by the Muskingum river and its tributaries. The sum of the amounts given may not equal the total for any given month as precipitations of less than one-tenth of an inch have been omitted.

For convenience the observing stations are grouped by river basins as follows:

- I. Walhonding creek and tributaries.
- II. Licking creek.
- III. Wills creek.
- IV. Tuscarawas river (including Big Stillwater and Nimishillen creeks.)
- V. Muskingum river

WEATHER HISTORY OF SAMPLES.

From the preceding table and the general statement in the monthly reports of the Bureau, we derive the following weather history of the various samples:

APRIL.

The temperature was 2.2 degrees F. above the normal while the deficiency in precipitation was 1.58 inches for the state, making a warm, dry April. All of the twenty-seven observing stations on the Muskingum watershed reported a deficiency in rainfall except Canton, where the exception was due to a heavy local rain of 1.74 inches on the 26th. Some of the stations reported the driest April ever recorded by them. Of the eight months, covering the period of our analytical work on this watershed, April yielded the lowest average for the total monthly rainfall.

Samples from the southern portion of the watershed were taken on the 28th and 29th, and represent fair weather conditions with no recent rains or only light ones (less than .5 of an inch) some three or four days previous to the date of sampling. At Cambridge the rainfall was but one day previous to the sampling. The northern samples, taken May 3-6, inclusive, likewise follow a dry period and, like the foregoing, represent an unusually low condition of the streams for the season. A general one-day rain varying from .2 to .5 of an inch occurred during the sampling period.

MAY.

The month was warm, 2.4 degrees above the normal, and rather wet, .69 inches above the normal for the state, or .78 inches for the watershed. In addition, it should be noted, only a small proportion of the rainfall occurred in the first half of the month, yet the sampling was done in the second half, and consequently all the samples show much rain influence, while in most cases the river was at the highest stage found by us.

The southern collections were made on the 23d-25th during an interval of fair weather between rainy periods. They show the effect of the heavy rains of the preceding week on the upper tributaries. The northern collections were made on the 29th-31st in the general heavy rains extending from the 27th to the end of the month, and represent the water in a spring flood.

JUNE.

The mean temperature of the state was 1.2 degrees above the normal, while the departure from the normal precipitation was .56 inches, although the stations on the watershed showed an excess of .48 inches. The rainfall was not evenly distributed.

The southern samples collected on the 21st-23d, show the effect of the general heavy rains which fell on the 19th and 20th over the whole watershed, but were especially heavy in the western and northwestern portions. The northern samples, 27th-29th, were preceded by a short period of generally fair weather, although some of the observing stations recorded slight rains on the first days of this trip.

JULY.

The excess of temperature for the state was but a trifle; and so was the excess of precipitation for the watershed, only .04 of an inch. The average rainfall reported on the watershed was greater for July than for any other month during our study. While this monthly rainfall slightly exceeded that of May, it was far more uniformly distributed through the month, and with no unusual single rainfall. These facts with the difference in season and temperature show why the streams were found so much lower and better in July than in May.

The northern samples were taken on the 18th, 19th, and 20th. Moderate to heavy rains fell almost daily from the 13th to the 20th, but the heavy rains at the beginning of this period had washed the watershed, and hence the surplus organic matter usually brought in by surface washings had been largely removed. The southern samples were taken on the 24th, 25th, and 27th, and represent a short period of fair weather conditions. Moderate to heavy rains fell on the 25th and 26th, but they influenced, of course, only the samples taken at Newark and Zanesville on the 27th.

AUGUST.

This was a hot, dry month, the departure from the normals for the state being plus 2.5 degrees and minus 1.09 inches. The deficiency in

precipitation on the watershed was 1.25 inches, while the average total rainfall was only 1.66 inches. A few observing stations reported a light rain about the 10th, otherwise the table shows no rainfall between the 6th and 26th; accordingly the northern samples were taken (17th-19th) during a hot, dry spell extending from the 6th of the month, while the southern collections on the 29th-31st show no effect from the recorded rains of the 26th and 27th, since these were not extended enough in view of the prevailing drought to influence the streams.

SEPTEMBER.

The first of the month was hot, with little rain; the latter part of the month was cool and rather wet, so that the departures from the normals for the state were minus 1.4 degrees and plus .06 inches. The watershed gave an excess of .86 inches as only five of the stations reported a deficiency.

Light to heavy rains fell during the northern sampling period (18th-20th), but previously there had been some ten days of fair weather, and so the samples were influenced but little as a rule. The weather then cleared until the second sampling period, when moderate rains fell. The southern collections were made on September 26th, 27th, and 28th.

OCTOBER.

The month was warmer than usual as shown by an excess of 4.9 degrees in temperature for the state, but the precipitation was nearly normal, the excess being .06 and .04 of an inch for the state and watershed, respectively.

Light rains fell at the beginning of the northern sampling period (10th to 12th), but the cool, dry weather prevailing during the preceding fortnight minimized their effect. Another week of clear weather ensued, when light rains occurred during the period of collections for the southern samples, viz., October 16th, 17th, and 18th.

NOVEMBER.

The month was very warm and dry, the mean temperature for the state showing an excess of 3.2 degrees, while the departure from the normal precipitation was -1.60 inches.

The northern collections were made on the 14th to the 16th of the month, with light or moderate rains falling on the first two days of the sampling period, but the weather for the month had been fair except for light rains on the 3d and 4th. Then no rain of moment fell until the last day of the sampling period for the southern samples, and the samples of that day were taken before the rain had fairly started. The last collections were made on the 21st-23d. Thus it is seen that the November samples represent unusually low stages of the river for the time of year, as they were taken after a dry period in the late fall.

TABLE SHOWING RESULTS OF CHEMICAL AND BACTERIOLOGICAL

(Parts per

NIMISHILLEN CREEK (WEST BRANCH.)

Station.	Sample number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1	21	179	Canton, above town.	May 5	.25	.06	S.	Faint earthy.
	52	....	" " "	May 30	.50	.30	C.	Faint musty.
	83	....	" " "	June 28	.15	.03*	V. S.	None.
	102	....	" " "	July 19	.23	.03*	V. S.	Vegetative.
	132	....	" " "	Aug. 19	.10	.03*	T.	"
	162	....	" " "	Sept. 19	.13	.06	T.	"
	190	....	" " "	Oct. 11	.10	.03*	T.	"
	221	....	" " "	Nov. 16	.35	.09*	S.	"
	AVERAGE .....			.....	.23	.08	.....	.....

NIMISHILLEN CREEK.

1a	22	176	Canton, below town.	May 5	.40	.09*	S.	None.
	53	....	" " "	May 30	.50	.32	C.	Faint musty.
	82	....	" " "	June 28	.15	.11*	S.	Musty.
	101	....	" " "	July 19	.25	.08*	S.	Strong musty.
	131	....	" " "	Aug. 19	.25	.08	V. S.	Foul.
	161	....	" " "	Sept. 19	.22	.26	C.	Very musty.
	189	....	" " "	Oct. 11	.20	.09	S.	Foul.
	220	....	" " "	Nov. 16	.25	.09	S.	Musty.
	AVERAGE .....			.....	.28	.18	.....	.....

BIG STILLWATER CREEK.

5	25	142	Uhrichsville and Den- nison, above town.	May 6	.20	.30	S.	None.
	58	....	" " "	May 31	.30	1.50	C.	Musty.
	89	....	" " "	June 29	.25	.81	C.	Faint musty.
	106	....	" " "	July 20	.23	.97	M.	Earthy, veg.
	133	....	" " "	Aug. 19	.35	.23	S.	Old tea.
	166	....	" " "	Sept. 20	.22	.05	S.	Earthy.
	186	....	" " "	Oct. 10	.18	.06	V. S.	None.
	217	....	" " "	Nov. 14	.25	.11	S.	Faint sour.
	AVERAGE .....			.....	.25	.50	.....	.....

5a	26	138	Uhrichsville and Den- nison, below town.	May 6	.22	.30	S.	None.
	59	....	" " "	May 31	.30	1.46	C.	Musty.
	88	....	" " "	June 29	.30	.85	C.	Earthy.
	105	....	" " "	July 20	.23	.53	M.	Earthy, veg.
	134	....	" " "	Aug. 19	.35	.17	S.	"
	165	....	" " "	Sept. 20	.22	.13	C.	Musty.
	185	....	" " "	Oct. 10	.20	.08	S.	Sour.
	215	....	" " "	Nov. 14	.20	.12	S.	Faint musty.
	AVERAGE .....			.....	.25	.46	.....	.....

* The stream was so shallow the turbidity stick rested on the bed of the stream with the wire still visible.

EXAMINATIONS OF WATERS OF MUSKINGUM RIVER AND TRIBUTARIES.

(Million.)

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
5.79	.136	.036	.002	.06	2.8	147.0	55.4	315	112	9.90	850	18.5
25.25	.512	.094	.004	.15	.5	50.7	15.3	192	71	6.86	7800	20.5
2.98	.122	.050	.008	.78	3.2	160.1	None	286	86	9.63	750	21.0
3.88	.139	.044	.006	.04	3.1	169.6	30.0	293	99	11.43	950	22.0
2.13	.102	.060	.008	.68	2.8	179.2	76.8	297	93	11.02	1200	21.0
3.59	.075	.043	.008	.05	1.1	171.4	15.0	273	93	8.92	1100	19.0
1.84	.064	.014	.002	T	.9	179.0	17.8	281	86	9.42	800	13.5
6.25	.258	.064	.008	1.01	1.2	147.8	70.6	418	165	10.10	5500	8.0
6.46	.176	.051	.006	.35	2.0	150.6	35.1	294	101	9.66	2369	.....

6.54	.138	.089	.010	.07	5.9	158.4	9.9	304	112	10.07	8000	17.0
28.14	.646	.095	.005	.17	1.3	52.1	5.4	225	64	6.66	16300	21.0
4.62	.402	.784	.060	.84	12.3	156.0	56.8	377	115	9.65	33400	24.0
6.04	.384	.720	.100	.09	14.3	179.2	44.8	335	99	6.70	77000	24.0
7.64	.764	1.620	None	.02	22.7	170.2	82.8	408	147	3.70	314000	22.0
6.08	.360	.422	.042	.15	7.5	153.0	65.4	332	97	6.42	67600	19.0
4.92	.608	1.980	.078	.16	14.4	198.4	67.6	395	128	6.03	210300	14.5
4.75	.264	.220	.018	.88	4.8	146.2	69.2	367	117	9.03	31800	8.5
8.59	.446	.741	.039	.30	10.4	151.7	50.2	343	110	7.28	94800	.....

2.51	.131	.053	.010	.02	1.2	112.0	None	271	61	6.81	700	19.5
22.85	.456	.037	.002	.12	7.2	47.1	36.4	735	77	6.69	6800	20.
9.13	.222	.134	.007	.13	3.8	98.4	14.0	324	70	6.02	4200	26.
7.13	.320	.080	.010	.05	1.4	92.0	5.2	386	86	6.23	600	26.
5.37	.362	.196	.014	.06	4.0	125.0	29.0	235	67	10.52	240	31.
4.95	.248	.092	.004	.09	5.8	163.8	6.4	274	96	5.90	500	22.
3.72	.142	.066	.001	.02	8.1	140.6	22.2	249	87	7.80	500	14.5
3.99	.178	.054	.005	.05	4.4	134.2	29.4	278	84	8.30	900	7.
7.46	.257	.089	.007	.07	4.5	114.1	17.8	344	78	7.28	1805	.....

3.17	.166	.086	.009	T	2.3	95.2	22.4	278	64	6.81	1000	19.5
26.56	.530	.049	.002	.91	7.4	40.4	6.3	753	99	6.52	10500	20.
12.32	.346	.150	.007	.17	6.6	59.5	26.6	332	85	5.46	4800	24.5
5.62	.222	.134	.006	.06	2.5	93.0	55.8	316	75	6.00	1100	27.5
5.21	.246	.152	.014	.04	5.6	114.2	19.4	231	68	8.60	950	29.
5.68	.334	.364	.009	.07	12.8	111.2	98.2	378	110	8.16	250	19.
4.18	.278	.346	.003	.05	12.4	160.4	42.4	318	90	6.07	1700	15.
3.20	.182	.226	.008	.04	7.2	116.6	50.2	399	57	8.15	1300	7.
8.24	.288	.188	.007	.17	7.1	98.8	40.2	376	81	6.97	2700	.....

T., trace; V. S., very slight; S., slight; C., considerable; M., much.

BACTERIOLOGICAL EXAMINATIONS, ETC. —Continued.

Million)

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Increasing constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
6.70	.166	.071	.008	.06	4.1	197.6	33.6	406	125	8.88	850	26.
26.14	.669	.110	.002	.11	T	120.8	13.9	956	117	7.55	3000	20.
5.91	.174	.070	.002	.10	1.5	176.8	33.8	354	113	9.48	300	26.
9.94	.268	.061	.016	.06	.9	153.6	84.8	407	108	8.17	Lost	27.
3.79	.246	.088	T	.02	4.3	191.6	81.6	428	119	7.82	450	26.5
4.79	.166	.053	T	.03	2.1	191.4	59.2	411	115	7.67	5500	29.5
4.26	.146	.033	T	None	1.3	227.4	48.2	414	122	7.90	850	18.
6.03	.132	.018	.004	.02	1.7	181.8	98.6	468	127	10.65	2900	8.
8.44	.245	.063	.004	.05	2.0	180.1	56.6	480	118	8.40	1979	.....
2.97	.238	.292	.015	.06	11.7	115.8	100.9	538	142	8.52	2300	26.
9.56	.530	.178	.032	.15	7.8	103.0	54.1	435	134	6.98	7000	20.5
4.26	.198	.138	.034	.12	12.5	137.8	87.0	473	150	8.19	700	26.
11.90	.352	.086	.022	1.25	6.3	110.2	88.8	383	96	7.90	Lost	27.5
3.07	.236	.072	T	.05	28.3	57.2	327.6	810	192	8.72	1500	27.
7.42	.442	.100	.002	.06	32.1	90.4	350.6	959	212	8.60	3600	21.
2.65	.100	.128	.014	.06	8.7	77.4	225.6	598	151	8.52	1700	8.5
5.98	.299	.142	.017	.25	15.3	98.8	176.4	599	154	8.20	2800	.....
2.42	.170	.081	.008	.03	1.3	197.6	46.9	421	124	11.42	750	18.5
29.80	1.432	.044	.003	.08	2.8	54.5	T	1168	117	7.21	5700	20.
4.17	.112	.068	.002	.06	1.2	171.4	27.4	370	107	8.63	1600	26.
4.56	.157	.028	.004	.05	2.4	171.6	64.2	376	106	9.22	Lost	26.5
1.80	.064	.056	.005	None	12.4	188.4	58.4	394	125	13.50	700	27.
2.98	.112	.064	.012	.04	.5	194.4	79.8	473	119	10.54	5000	20.
2.54	.084	.022	.003	.07	.6	207.8	93.2	425	121	10.68	2000	18.5
3.61	.128	.047	.006	.32	1.7	172.2	101.8	470	95	11.25	5400	5.5
6.48	.282	.051	.005	.08	2.9	160.7	59.0	512	114	10.31	3021	.....
5.81	.372	.708	.160	.10	14.4	201.6	27.5	404	113	1.08	73900	19.
39.94	.636	.128	.016	.15	10.9	130.3	49.3	1535	206	4.99	439800	20.5
7.96	.592	.556	.004	.13	31.4	208.7	30.2	466	145	3.73	151600	24.
6.27	.436	.356	.226	.34	17.4	188.0	61.8	407	131	2.12	Lost	25.5
4.74	.288	.680	.080	None	20.9	34.8	36.6	441	128	5.76	672000	24.
5.05	.252	1.064	.110	.32	17.5	27.4	57.0	495	158	2.62	212200	20.5
6.27	.448	.472	.086	.02	12.6	214.6	78.8	471	162	4.77	93800	19.
6.19	.280	.272	.022	.05	8.5	163.6	103.0	448	129	7.76	52100	6.5
10.28	.413	.530	.088	.14	16.7	146.1	55.5	583	146	4.10	242200	.....

TABLE SHOWING RESULTS OF CHEMICAL AND

(Parts per

APPLE CREEK.

Station.	Sample number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
9 ¹	18	152	Wooster, above town	May 4	.10	.07*	S.	None.
	49	....	" " "	May 30	.40	.85	C.	Earthy.
	81	....	" " "	June 28	.10	.06*	V. S.	Vegetative.
	96	....	" " "	July 19	.15	.09	V. S.	"
	128	....	" " "	Aug. 18	.05	.06*	V. S.	None.
	158	....	" " "	Sept. 19	.20	.24	C.	Earthy.
	195	....	" " "	Oct. 12	.10	.06*	V. S.	None.
	222	....	" " "	Nov. 16	.40	.12	S.	"
	AVERAGE .....			.....	.19	.19	.....	.....

KILLBUCK CREEK.

9 ²	17	150	Wooster, above town	May 4	.18	.28	S.	Faint earthy.
	50	....	" " "	May 30	.35	.15	S.	None.
	80	....	" " "	June 28	.20	.40	S.	Earthy.
	98	....	" " "	July 19	.22	.65	C.	Faint musty.
	127	....	" " "	Aug. 18	.50	.33	S.	"
	157	....	" " "	Sept. 19	.20	.68	C.	"
	194	....	" " "	Oct. 12	.25	.26	C.	Musty.
	224	....	" " "	Nov. 16	.40	.32	S.	Earthy.
	AVERAGE .....			.....	.29	.38	.....	.....

9a	16	148	Wooster, below town	May 4	.20	.19	S.	Faint musty.
	51	....	" " "	May 30	.38	1.10	C.	Earthy.
	79	....	" " "	June 28	.20	.35	C.	Musty.
	97	....	" " "	July 19	.22	.45	C.	"
	126	....	" " "	Aug. 18	.40	.32	S.	"
	156	....	" " "	Sept. 19	.25	.65	C.	"
	193	....	" " "	Oct. 12	.25	.23	C.	"
	223	....	" " "	Nov. 16	.35	.19	S.	Earthy.
	AVERAGE .....			.....	.28	.43	.....	.....

KOKOSING RIVER.

8	11	141	Mt. Vernon, above t'n	May 3	.05	.04	S.	None.
	43	....	" " "	May 29	.25	.21	C.	Earthy.
	74	....	" " "	June 27	.10	.08*	V. S.	None.
	91	....	" " "	July 18	.28	.32	S.	Faint musty.
	121	....	" " "	Aug. 17	.10	.05*	V. S.	None.
	151	....	" " "	Sept. 18	.10	.05*	V. S.	"
	200	....	" " "	Oct. 16	.05	.05*	V. S.	Faint musty.
	230	....	" " "	Nov. 21	.12	.05*	T.	None.
	AVERAGE .....			.....	.13	.11	.....	.....

BACTERIOLOGICAL EXAMINATIONS, ETC. — Continued.

Million.)

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
2.26	.072	.026	.005	.04	2.4	133.4	36.2	224	132	7.55	1600	19.
14.26	.448	.075	.004	.12	3.6	52.9	5.2	263	74	7.86	5800	17.
1.75	.098	.038	.002	.03	3.7	151.7	.....	220	89	8.92	450	22.5
3.30	.148	.050	.003	.04	3.4	149.0	20.6	240	74	8.72	500	21.
1.91	.092	.030	T	.06	2.2	157.8	9.8	250	79	10.00	300	24.
4.42	.173	.050	.004	.03	1.6	155.2	6.0	311	69	8.10	6400	18.5
2.38	.060	.024	T	T	1.7	176.6	20.8	260	87	10.07	375	16.5
3.60	.134	.012	.005	.08	2.1	145.4	34.4	268	72	10.50	5000	9.5
4.24	.153	.038	.003	.05	2.6	140.2	16.6	254	84	8.96	2553	.....
2.69	.142	.038	.004	.04	1.9	112.4	3.5	214	36	8.37	1300	20.
7.48	.164	.046	.003	.16	1.6	116.4	19.8	194	55	9.06	2600	19.5
8.41	.460	.094	T	T	6.4	148.2	.....	331	97	6.58	1100	20.5
5.89	.324	.138	.022	.05	10.2	124.2	6.8	377	76	5.60	1500	22.5
8.34	.548	.356	.012	.02	5.5	125.2	49.2	336	93	8.38	950	21.
7.89	.572	.092	.004	.04	4.6	127.4	6.2	413	101	5.42	3700	18.5
5.19	.268	.098	.001	.05	4.4	148.0	12.6	352	103	4.99	500	14.
6.04	.214	.038	.006	.03	8.3	139.2	88.8	471	113	9.89	4600	8.5
6.49	.336	.112	.006	.05	5.4	130.1	23.4	336	84	7.29	2031	.....
4.04	.324	.116	.018	.06	3.9	121.4	7.4	258	74	8.16	1500	20.
16.32	.548	.110	.006	.36	4.2	93.9	9.3	439	74	7.31	10100	20.
6.99	.282	.234	.028	.12	7.3	146.4	.....	327	88	5.80	13000	19.
5.59	.302	.166	.036	.06	8.9	127.6	5.6	338	88	6.70	3500	22.
4.90	.314	.264	.050	.01	7.6	130.8	47.8	323	84	6.72	3700	20.
7.26	.360	.160	.010	.03	4.8	130.2	38.4	419	91	5.70	29100	18.5
4.84	.234	.164	.011	.03	7.8	155.8	34.6	343	106	5.65	5900	14.5
5.22	.212	.108	.014	.04	7.5	138.0	83.0	423	86	9.97	7400	9.
6.89	.322	.165	.022	.09	6.5	130.5	28.3	359	86	7.00	9250	.....
2.32	.084	.044	.007	.02	.6	174.0	11.1	295	69	10.17	650	24.
3.46	.155	.057	.006	.08	.8	175.1	.....	310	83	8.05	950	20.
2.55	.093	.058	.003	.02	1.4	194.5	.....	266	86	9.21	230	21.5
9.00	.204	.033	.004	.62	.8	148.8	27.4	264	67	8.01	Lost	23.5
2.23	.111	.042	.002	.....	3.5	206.6	9.6	247	92	9.05	170	22.
1.89	.054	.022	.001	.06	.6	209.2	11.6	288	96	8.90	160	19.5
2.22	.014	.017	T	.04	.7	220.4	23.8	309	66	9.80	500	17.
2.80	.048	.016	T	.19	.9	207.8	27.8	278	52	11.15	375	7.
3.31	.095	.036	.003	.05	1.2	192.0	13.9	282	76	9.29	434	.....

TABLE SHOWING RESULTS OF CHEMICAL AND

(Parts per

Station.	Sample number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.	
8a	10	138	Mt. Vernon, below t'n	May 3	.10	.06*	S.	None.	
	44	....	" "	May 29	.30	.52	C.	Faint musty.
	73	....	" "	June 27	.12	.10	V. S.	" "
	90	....	" "	July 18	.25	.23	C.	Musty.
	120	....	" "	Aug. 17	.10	.07*	V. S.	Faint musty.
	150	....	" "	Sept. 18	.10	.07*	V. S.	" "
	199	....	" "	Oct. 16	.05	.07*	V. S.	None.
	229	....	" "	Nov. 21	.12	.06*	T.	"
	AVERAGE14	.15
	WALHONDING CREEK.								
10 ²	28	100	Coshocton, above t'n	May 6	.15	.09	S.	None.	
	39	....	" "	May 25	.30	.32	S.	"
	71	....	" "	June 23	.24	1.30	C.	Earthy.
	108	....	" "	July 24	.23	.19	C.	Faint veget'e.
	138	....	" "	Aug. 29	.22	.15	S.	Faint sour.
	168	....	" "	Sept. 26	.25	.44	C.	Earthy.
	182	....	" "	Oct. 10	.15	.17	S.	Faint sour.
	211	....	" "	Nov. 14	.15	.08	V. S.	Slightly veg.
	AVERAGE21	.34
	LICKING CREEK.								
12	9	95	Newark. above town	May 3	.05	.04*	V. S.	None.	
	41	....	" " "	May 25	.10	.03*	V. S.	"
	68	....	" " "	June 23	.28	.65	C.	Earthy.
	115	....	" " "	July 27	.25	.57	C.	Vegetative.
	149	....	" " "	Aug. 31	.10	.03*	V. S.	None.
	178	....	" " "	Sept. 28	.07	.03*	T.	"
	181	....	" " "	Oct. 10	.05	.03*	T.	"
	210	....	" " "	Nov. 14	.12	.04*	T.	"
	AVERAGE13	.18
	12a	8	92	Newark, below town	May 3	.05	.05*	V. S.	None.
42		....	" " "	May 25	.13	.06*	V. S.	Musty.
69		....	" " "	June 23	.30	.78	C.	Earthy.
114		....	" " "	July 27	.25	.52	C.	Sour musty.
148		....	" " "	Aug. 31	.10	.06*	V. S.	Musty.
179		....	" " "	Sept. 28	.10	.03	T.	None.
180		....	" " "	Oct. 10	.05	.03	T.	"
209		....	" " "	Nov. 14	.12	.03	V. S.	"
AVERAGE .....				.....	.14	.20	.....	.....

BACTERIOLOGICAL EXAMINATIONS, ETC., — Continued.

(Million.)

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia	Nitrites.	Nitrates.								
1.78	.106	.054	.012	.02	3.9	173.2	69.1	273	86	9.21	2000	24.
5.22	.288	.074	.011	.10	1.4	168.7	.....	393	96	7.65	4900	20.
2.35	.092	.069	.010	.11	3.7	189.2	.....	287	93	8.50	1400	21.
7.00	.214	.045	.012	.03	2.2	152.6	47.8	272	81	7.71	Lost	23.
1.76	.074	.048	.006	.02	4.5	206.2	13.0	315	93	9.00	850	22.
2.67	.072	.124	.007	.07	3.7	211.8	35.8	302	97	8.72	750	20.
1.57	.069	.035	.006	.05	2.9	220.0	73.4	305	96	9.78	1800	17.
1.45	.056	.030	.005	.20	2.3	203.6	27.4	280	81	10.86	1200	7.
2.98	.121	.060	.009	.08	3.1	190.7	33.3	303	90	8.93	1843	.....

2.24	.102	.027	.002	.03	1.9	138.6	2.5	214	49	8.77	425	20.
7.39	.182	.060	.007	.09	2.6	123.6	4.8	316	72	7.85	700	17.
12.45	.460	.112	.002	.04	2.4	65.2	11.4	493	75	6.95	4000	26.
3.42	.149	.040	.002	.06	5.4	157.8	37.4	274	92	8.34	240	28.5
3.57	.198	.026	.002	.52	9.9	148.0	19.8	263	98	8.91	900	24.5
4.92	.189	.047	.005	.05	6.2	140.2	5.4	324	88	8.49	1700	15.5
3.16	.106	.036	.001	.04	8.3	174.0	11.4	293	85	10.07	270	14.
2.75	.112	.014	.007	.03	6.3	164.6	22.2	246	63	11.35	230	7.
4.99	.187	.045	.004	.01	5.4	139.0	14.4	303	78	8.84	1058	.....

2.26	.060	.019	.004	.02	1.4	165.5	43.8	300	72	9.13	170	19.5
1.82	.074	.010	.001	.06	1.3	184.6	None	288	82	9.75	95	22.
12.86	.260	.092	.005	.06	.8	155.0	17.8	367	88	7.75	2000	22.
7.19	.276	.052	.005	.05	1.2	145.8	None	392	90	7.78	1300	25.5
1.29	.052	.032	.002	None	.9	159.0	55.2	289	90	8.50	300	27.5
1.54	.054	.006	T	.06	2.8	212.2	6.0	277	78	9.40	475	17.
1.22	.040	.015	T	None	2.8	213.0	27.2	279	65	10.06	160	12.
.75	.032	.006	.002	.03	1.7	201.0	20.2	278	91	11.20	1100	7.5
3.62	.106	.029	.002	.04	1.6	184.0	21.3	309	82	9.20	700	.....
2.62	.090	.064	.012	.02	2.8	139.4	21.6	316	99	8.54	2500	20.
2.62	.124	.016	.033	.08	1.6	179.3	None	285	80	8.67	1700	22.
4.44	.400	.132	.008	.17	1.0	86.2	12.6	306	87	6.20	9600	25.
8.96	.340	.226	.007	.07	3.5	143.6	None	416	107	7.56	6500	25.
1.80	.108	.080	.007	.06	4.7	230.0	18.8	335	112	7.63	6000	26.5
1.87	.108	.076	.004	.09	4.2	224.0	None	331	93	8.28	4700	17.
1.77	.061	.050	.004	.05	3.7	229.4	28.8	333	99	9.07	1300	13.
2.91	.062	.056	.006	.04	2.4	219.0	25.4	308	101	9.98	9000	7.
4.62	.162	.088	.006	.07	3.0	181.4	13.4	329	97	8.24	5162	.....

BACTERIOLOGICAL EXAMINATIONS, ETC.—Continued.

Million.

Oxygen required.	Nitrogen as											
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.	Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
2.51	.114	.033	.004	.07	3.9	179.7	19.6	299	47	9.50	450	17.
10.99	1.124	.224	.002	.05	2.6	84.4	32.8	1606	147	7.75	15200	22.5
8.37	.326	.070	.008	.05	1.6	108.2	19.6	416	79	7.55	375	28.
3.32	.142	.038	.002	.01	4.9	192.6	6.4	319	105	8.08	250	25.5
1.74	.077	.015	.003	.08	4.1	199.6	1.8	299	93	9.80	250	13.5
2.40	.104	.018	.014	T	2.9	193.6	35.2	339	91	8.82	550	18.5
2.03	.126	.018	.007	.10	3.1	199.0	34.2	295	74	10.24	1800	9.5
4.48	.288	.059	.006	.05	3.2	165.3	21.4	510	91	8.82	2696	.....
3.68	.120	.074	.006	.12	3.1	135.9	2.4	279	79	8.79	275	20.5
3.04	.129	.052	.004	.04	3.7	171.1	12.6	286	91	8.17	300	17.5
9.80	.544	.132	.001	.07	1.2	65.6	49.0	1083	115	6.92	14200	22.5
10.69	.400	.084	.004	.06	1.4	88.6	8.2	434	80	6.67	400	27.5
2.95	.162	.052	.004	.07	5.0	217.6	8.8	308	97	8.00	325	25.5
2.74	.128	.054	.002	.07	4.1	196.6	32.8	311	69	8.55	750	13.5
3.20	.144	.046	.014	None	3.0	208.2	20.0	358	61	7.35	650	18.5
1.91	.094	.042	.007	.11	3.4	192.6	19.8	296	60	10.30	1900	9.5
4.75	.215	.064	.005	.07	3.1	159.5	19.2	419	69	8.09	2350	.....
2.98	.204	.134	.007	.15	163.4	137.2	88.7	786	204	7.62	350	21.5
9.53	.180	.112	.020	.09	4.5	143.2	42.8	354	112	6.59	950	18.5
14.31	.816	.208	.007	.09	5.0	83.0	1.6	968	128	5.35	2500	25.5
6.91	.336	.124	.090	.43	4.5	118.6	20.0	301	83	5.26	650	30.
4.35	.240	.094	.002	.05	8.3	152.6	43.6	348	95	7.20	650	25.5
5.27	.224	.076	.006	.06	7.3	112.4	81.0	317	83	5.85	2000	14.5
4.34	.073	.092	.004	.03	12.2	176.4	16.4	391	91	4.40	1200	20.
3.28	.144	.034	.003	.02	7.2	170.8	31.6	328	88	8.65	4070	8.
6.37	.277	.109	.017	.12	26.6	136.8	40.7	474	110	6.35	1546	.....
2.25	.177	.152	.007	.16	5.6	125.9	52.3	336	98	7.01	1000	22.
6.32	.152	.162	.031	.13	5.3	102.6	20.4	279	75	5.21	1000	17.5
7.64	.444	.248	.009	.08	6.6	89.0	18.4	442	93	5.32	4400	25.5
5.27	.356	.184	.102	.62	13.0	80.4	77.8	298	111	8.19	1500	30.
4.55	.192	.208	.008	.08	12.1	29.4	151.4	404	82	4.62	950	25.5
5.55	.188	.395	.024	.05	14.7	28.8	134.6	335	59	3.50	1500	16.
4.85	.226	.200	.004	None	13.9	137.2	40.8	376	93	5.12	4000	18.5
3.05	.144	.086	.004	.02	9.0	146.8	29.2	344	80	8.28	3500	8.
4.94	.235	.204	.025	.14	10.0	92.5	65.6	352	86	5.91	2231	.....

TABLE SHOWING RESULTS OF CHEMICAL AND

Parts per

TUSCARAWAS RIVER.

Station.	Sample number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
2	19	174	Massillon, above town	May 5	.30	.07*	S.	Faint earthy.
	54	....	" " "	May 30	.22	.66	C.	Earthy.
	85	....	" " "	June 28	.20	.11*	V. S.	Faint veg.
	100	....	" " "	July 19	.20	.06*	V. S.	Vegetative.
	130	....	" " "	Aug. 18	.30	.06	V. S.	Vegetative.
	160	....	" " "	Sept. 19	.24	.08	S.	Faint musty.
	191	....	" " "	Oct. 11	.10	.04*	V. S.	Slight veg.
	219	....	" " "	Nov. 15	.30	.09	S.	Vegetative.
	AVERAGE .....				.23	.15	.....	.....
2a	20	172	Massillon, below town	May 5	.30	.14	S.	Musty.
	55	....	" " "	May 30	.22	.68	C.	Earthy.
	84	....	" " "	June 28	.25	.09	C.	Strong musty.
	99	....	" " "	July 19	.30	.12	S.	Mouldy.
	129	....	" " "	Aug. 18	.35	.09	S.	Strong musty.
	159	....	" " "	Sept. 19	.30	.42	C.	Musty.
	192	....	" " "	Oct. 11	.30	.09	C.	"
	218	....	" " "	Nov. 15	.30	.11	S.	Vegetative and faint musty.
	AVERAGE .....				.29	.22	.....	.....
3	23	147	Canal Dover, above t'n	May 5	.25	.27	S.	Faint earthy.
	56	....	" " "	May 31	.29	.85	C.	Faint musty.
	86	....	" " "	June 29	.18	.40	S.	Earthy.
	103	....	" " "	July 20	.25	.35	S.	"
	135	....	" " "	Aug. 21	.25	.22	S.	Faint musty.
	163	....	" " "	Sept. 20	.15	.27	C.	Veg., earthy.
	188	....	" " "	Oct. 11	.18	.13	S.	Faint sour.
	217	....	" " "	Nov. 15	.28	.11	S.	Musty.
	AVERAGE .....				.23	.32	.....	.....
4a	24	140	New Philadelphia, below town	May 5	.20	.27	S.	Faint earthy.
	57	....	" " "	May 31	.30	.88	C.	Faint musty.
	87	....	" " "	June 29	.18	.37	S.	Earthy.
	104	....	" " "	July 20	.25	.29	S.	Earthy, veg.
	136	....	" " "	Aug. 21	.25	.17	S.	Faint musty.
	164	....	" " "	Sept. 20	.25	.55	C.	Veg., earthy.
	187	....	" " "	Oct. 11	.20	.10	S.	None.
	216	....	" " "	Nov. 15	.30	.09	S.	Faint musty.
	AVERAGE .....				.24	.34	.....	.....

BACTERIOLOGICAL EXAMINATIONS, ETC. — Continued.

Million.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Increasing constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
5.96	.116	.046	.003	.04	60.7	130.6	30.7	440	125	7.75	1000	18.
19.93	.356	.088	.004	.18	28.0	72.9	3.4	425	114	7.15	8000	20.
3.42	.122	.052	.002	.03	126.0	150.5	6.6	574	169	9.46	950	24.
4.57	.176	.084	.002	.09	160.3	128.2	94.0	629	134	9.70	750	24.5
3.31	.220	.072	.001	.01	76.8	154.8	74.4	365	140	9.02	325	24.
3.24	.132	.046	.003	.01	194.1	154.4	115.0	687	139	6.35	4500	18.5
3.02	.102	.046	.001	T	77.3	160.0	62.6	482	150	9.35	1200	14.5
4.26	.178	.044	.005	.12	99.2	143.4	77.6	505	73	8.90	7900	7.5
5.96	.175	.060	.003	.06	102.8	136.8	58.8	513	130	8.46	3078	.....
9.91	.195	.060	.002	.03	32.2	136.6	43.0	356	112	6.76	6900	19.
9.36	.430	.092	.005	.19	23.3	70.5	5.7	395	90	6.22	12500	20.5
9.41	.296	.072	.010	.12	81.5	162.4	5.8	455	144	5.77	7200	24.5
8.69	.266	.120	.014	.12	137.6	148.8	56.8	609	156	5.12	17000	25.5
8.36	.588	.128	None	None	43.0	178.6	39.8	1388	1136	4.10	29200	24.
9.05	.474	.086	.002	.09	104.5	173.6	43.6	608	148	4.81	26300	18.5
8.36	.288	.096	.009	.06	48.3	187.4	36.4	447	131	6.58	16400	14.5
4.21	.208	.092	.014	.21	45.9	163.2	37.4	440	118	7.90	16600	7.5
9.67	.343	.093	.007	.10	64.5	152.6	33.6	587	254	5.91	16500	.....
4.86	.173	.054	.004	.05	14.9	112.0	56.1	279	77	7.65	1000	21.
23.04	.448	.071	.002	.10	3.8	42.0	7.7	405	77	6.44	6000	20.
3.64	.212	.068	.006	.13	26.8	82.8	38.8	305	92	6.73	2100	22.5
5.51	.228	.106	.010	.06	33.6	96.6	44.6	331	122	6.54	650	24.
4.04	.266	.048	.002	.06	27.8	147.6	39.8	506	122	7.95	750	25.
4.10	.164	.060	.004	.06	29.6	135.2	38.0	357	110	6.52	3400	18.5
2.59	.100	.040	.002	.02	31.6	147.6	46.4	394	131	9.83	1200	13.5
3.45	.224	.048	.007	.06	22.8	138.4	42.8	372	93	10.71	3700	7.
6.40	.227	.062	.005	.07	23.9	112.8	39.3	369	103	7.80	2350	.....
3.19	.148	.055	.006	.07	13.8	101.4	10.8	288	77	8.21	4000	19.5
24.25	.626	.076	.002	.10	4.8	36.8	9.1	432	75	7.52	11300	19.5
4.48	.220	.072	.007	.13	19.6	80.0	11.4	256	75	7.63	2500	22.
4.45	.194	.059	.010	.07	34.0	92.6	31.6	305	121	7.13	1600	24.
3.06	.214	.034	.003	.28	28.0	147.4	80.2	338	95	7.18	1500	23.5
3.72	.222	.086	.006	.08	28.5	126.8	33.0	396	115	6.42	19500	18.5
2.97	.128	.060	.002	.04	27.3	139.4	43.6	332	93	8.61	2900	13.5
2.66	.144	.036	.007	.05	31.3	135.0	63.8	399	84	10.20	6300	6.5
6.10	.237	.060	.005	.10	23.4	107.4	36.2	343	86	7.86	6200	.....

TABLE SHOWING RESULTS OF CHEMICAL AND

TUSCARAWAS RIVER — Concluded.

Parts per

Station.	Sample number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
10 ¹	29	99.5	Coshocton, above town	May 6	.18	.13	S.	None.
	38	....	" " "	May 25	.30	.26	S.	"
	70	....	" " "	June 23	.15	.19	S.	Faint veg.
	107	....	" " "	July 24	.14	.12	S.	Faint tea.
	139	....	" " "	Aug. 29	.15	.21	C.	Faint sour.
	167	....	" " "	Sept. 26	.10	.16	S.	Earthy.
	183	....	" " "	Oct. 10	.15	.13	V. S.	Old tea.
	212	....	" " "	Nov. 14	.15	.06	V. S.	Earthy.
			AVERAGE .....		.16	.16	.....	.....
MUSKINGUM RIVER.								
10a	27	98	Coshocton, below town	May 6	.20	.16	S.	None.
	40	....	" " "	May 25	.33	.28	S.	"
	72	....	" " "	June 23	.22	.80	C.	Earthy.
	109	....	" " "	July 24	.18	.22	C.	Tea.
	137	....	" " "	Aug. 29	.18	.23	C.	Musty.
	169	....	" " "	Sept. 26	.20	.30	C.	Earthy.
	184	....	" " "	Oct. 10	.15	.19	S.	Faint musty.
	213	....	" " "	Nov. 14	.15	.08	S.	Earthy.
			AVERAGE .....		.20	.28	.....	.....
13 ¹	3	70	Zanesville, above town	April 29	.20	.40	C.	None.
	33	....	" " "	May 23	.25	.90	C.	Faint earthy.
	61	....	" " "	June 21	.25	4.30	C.	Earthy.
	119	....	" " "	July 27	.25	1.00	C.	"
	147	....	" " "	Aug. 31	.25	.48	C.	Musty.
	177	....	" " "	Sept. 28	.30	.90	C.	Earthy.
	205	....	" " "	Oct. 18	.25	.26	C.	"
	235	....	" " "	Nov. 23	.25	.25	V. S.	None.
			AVERAGE .....		.25	1.06	.....	.....
13a	4	67	Zanesville, below town	April 29	.20	.40	C.	None.
	32	....	" " "	May 23	.25	.50	C.	Faint musty.
	60	....	" " "	June 21	.25	4.00	C.	Earthy.
	118	....	" " "	July 27	.25	1.00	C.	"
	146	....	" " "	Aug. 31	.25	.58	C.	Musty.
	176	....	" " "	Sept. 28	.30	.85	C.	Faint oily.
	206	....	" " "	Oct. 18	.22	.22	C.	Musty.
	236	....	" " "	Nov. 23	.20	.26	V. S.	Faint mouldy.
			AVERAGE .....		.24	.98	.....	.....

BACTERIOLOGICAL EXAMINATIONS, ETC. — Continued.

Million.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Increasing constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia	Nitrites.	Nitrates.								
2.54	.101	.020	.001	T	8.1	100.6	9.7	265	77	8.00	650	20.5
5.00	.160	.029	.009	.07	6.5	77.7	5.2	248	73	8.10	500	17.0
3.77	.208	.068	.001	.13	18.0	111.3	20.2	298	85	8.10	450	28.0
2.75	.149	.032	.001	.10	26.6	116.2	30.2	277	112	8.47	200	29.5
2.80	.148	.024	.001	None	15.3	141.0	42.8	322	106	8.42	400	24.5
3.26	.115	.013	.002	.03	27.3	129.8	59.4	332	95	8.70	400	15.0
2.28	.052	.019	.001	.03	33.8	145.6	40.8	370	104	10.52	210	14.0
2.26	.094	.016	.005	.06	29.3	129.6	24.8	313	128	11.96	120	7.0
3.08	.128	.028	.003	.05	20.6	119.0	29.1	303	98	9.03	866	.....
2.69	.160	.044	.003	.03	8.3	104.6	33.8	266	88	8.27	2200	20.
7.49	.190	.026	.008	.05	6.5	79.1	13.3	293	74	7.60	2000	17.5
4.95	.276	.088	.002	.08	15.4	102.5	69.6	367	94	7.75	3800	28.
3.55	.222	.058	.003	.08	25.5	117.6	31.8	321	116	8.17	3200	29.5
3.41	.200	.054	.006	.02	15.2	138.2	79.0	319	136	7.20	14900	24.5
3.51	.130	.022	.005	.04	24.2	137.2	29.2	364	109	7.55	4100	15.
3.88	.122	.037	.003	.07	32.1	144.0	82.6	382	106	9.36	3400	15.5
2.91	.136	.012	.008	.05	27.9	139.8	54.4	318	198	11.20	800	7.
4.05	.180	.043	.005	.05	19.4	120.4	49.2	329	104	8.39	4300	.....
5.31	.174	.086	.006	.12	2.6	93.0	80.4	353	102	7.97	350	20.5
13.16	.320	.046	.009	.06	3.6	78.9	44.5	424	84	8.08	1100	17.5
11.76	.764	.124	.001	.09	1.1	51.7	30.4	1361	141	6.10	15900	22.
5.26	.288	.041	.005	.05	9.5	95.8	21.6	363	101	6.85	1000	27.5
4.36	.226	.066	.004	.08	9.7	166.6	23.2	328	105	8.62	850	29.
4.71	.179	.042	.005	.02	16.1	137.0	43.2	440	100	8.05	750	15.
3.33	.144	.066	.014	.04	21.1	145.8	14.8	385	97	6.95	200	19.
3.02	.182	.030	.005	.18	16.1	145.2	29.4	334	84	10.24	1800	9.5
6.36	.285	.063	.006	.08	10.0	114.2	35.9	498	102	7.86	2744	.....
4.71	.224	.116	.007	.15	5.6	93.7	31.2	261	96	8.53	2700	20.5
7.96	.236	.058	.012	.07	5.6	59.4	41.6	305	78	8.78	3100	18.
17.15	.772	.144	.002	.14	1.4	60.9	14.0	1496	144	5.41	47400	22.
7.16	.372	.128	.004	.07	6.5	90.2	8.2	442	96	6.47	*650	27.5
6.26	.254	.085	.013	None	10.5	154.8	41.8	495	158	7.75	6000	28.
5.83	.278	.044	.004	.06	13.7	152.2	12.0	511	107	7.96	10800	15.
3.53	.216	.092	.020	.04	18.2	166.2	3.2	382	98	7.48	3800	18.
2.01	.240	.118	.012	.13	14.9	172.4	35.2	349	102	9.72	21300	9.5
6.83	.324	.098	.009	.08	9.6	118.7	23.4	530	110	7.76	11969	.....

* Count low from interference by overspreading growths.

TABLE SHOWING RESULTS OF CHEMICAL AND
MUSKINGUM RIVER — Concluded.

Parts per

Station.	Sample number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
14	2	41	McConnelsville, above town	April 28	.10	.20	C.	None.
	34	....	"	May 24	.28	.55	C.	Faint earthy.
	64	....	"	June 23	.20	3.70	C.	Earthy.
	113	....	"	July 25	....	.45	S.	Veg., earthy.
	143	....	"	Aug. 30	.22	.28	S.	Vegetative.
	173	....	"	Sept. 27	.20	.17	S.	Earthy.
	204	....	"	Oct. 17	.10	.14	S.	Veg., earthy.
	234	....	"	Nov. 22	.20	.14	V. S.	None.
	AVERAGE .....				.19	.70	....	.....
15	1	2	Marietta, above town	April 28	.10	.14	S.	Faint woody.
	35	....	" " "	May 24	.25	.90	C.	Faint earthy.
	65	....	" " "	June 22	.22	3.50	C.	"
	112	....	" " "	July 25	.28	.45	C.	Vegetative.
	142	....	" " "	Aug. 30	.20	.20	S.	Earthy.
	172	....	" " "	Sept. 27	.25	.20	S.	"
	203	....	" " "	Oct. 17	.10	.27	V. S.	Faint sour.
	233	....	" " "	Nov. 22	.10	.13	V. S.	None.
	AVERAGE .....				.19	.70	....	.....

RESULTS OF EXAMINATIONS.

The analytical results obtained from the samples taken monthly during 1899, April to November, inclusive, just given in tabulated form, will now be given by plotted curves. In the table, the first column gave the station number; the second, the serial number of the sample as collected; the third, the approximate distance in miles by river from the station to the mouth of Muskingum river; the fourth, the locality of the sample; the fifth, the date of collection; and the remaining columns the results, which are expressed in parts per million, except for color, turbidity,

BACTERIOLOGICAL EXAMINATIONS, ETC. — Concluded.

Million.*

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
3.12	.178	.068	.004	.08	5.8	101.1	56.8	269	84	8.81	350	20.
14.28	.234	.060	.007	.08	3.8	73.0	50.0	304	72	7.22	1400	17.
22.33	1.064	.152	.003	.13	2.1	44.5	7.6	1784	171	7.22	7000	21.
4.12	.230	.058	.009	.26	11.8	90.8	21.8	296	99	8.05	1400	28.5
3.50	.228	.156	.018	.04	14.8	147.2	40.0	329	93	6.70	1400	23.
4.61	.164	.046	.012	.10	14.3	152.2	None	306	99	8.35	425	19.
3.66	.140	.028	.015	.06	15.7	152.2	31.8	308	85	8.50	375	18.
2.71	.162	.034	.004	.11	19.0	142.2	49.0	315	101	9.02	425	9.5
7.29	.300	.075	.009	.11	10.9	112.9	32.1	489	100	7.98	1597	.....
2.48	.102	.056	.002	.10	5.7	112.4	57.9	275	77	9.01	350	20.
25.96	.216	.046	.009	.09	2.9	71.8	22.4	396	82	8.75	550	19.5
6.27	.464	.136	.004	.12	9.3	93.9	52.0	1017	135	7.91	3900	24.5
4.29	.296	.066	.008	.05	8.2	93.6	17.0	264	70	8.25	600	23.5
3.50	.202	.052	.012	.04	8.9	122.2	55.0	245	76	8.07	170	27.5
3.53	.158	.022	.010	.05	13.5	143.6	6.4	304	93	8.12	300	17.5
2.71	.120	.016	.008	.03	11.2	146.8	62.0	300	58	9.00	275	19.
2.87	.112	.006	.004	.16	17.9	144.2	39.4	322	91	10.75	1700	9.
6.45	.209	.050	.007	.08	9.7	116.1	39.0	390	85	8.73	981	.....

bacteria, and temperature. The color readings are expressed by the cobalt-platinum scale, the turbidity by Hazen's platinum wire scale, and the bacterial results show the number present in one cubic centimeter. In stating the numbers of bacteria, we have followed the practice recommended by Fuller and Johnson,* viz.: When the count is below 50 it is recorded to the unit; from 50 to 100, to the nearest 5; 100 to 250, to the nearest 10; 250 to 500, to the nearest 25; 500 to 1,000, to the nearest 50; and over 1,000 to the nearest 100.

* American Public Health Association, Vol. XXV, P. 578.

LIST OF PLATES.

With a large river like the Muskingum, which receives the water of several tributaries, it becomes necessary, in plotting the results, to separate some of the tributaries from the mother stream. Accordingly we have made three series of plates, including six sets of curves and fifty-three plates, as follows:

SERIES 1.

Curve A. NIMISHILLEN Creek, TUSCARAWAS River, and MUSKINGUM River.

- 1 and 1a. Oxygen required.
- 2 and 2a. Albuminoid ammonia.
- 3 and 3a. Free ammonia.
- 4. Nitrites.
- 5. Nitrates.
- 6 and 6a. Chlorine.
- 7 and 7a. Alkalinity.
- 8. Incrusting constituents.
- 9. Dissolved oxygen.
- 10 and 10a. Total solids.
- 11 and 11a. Bacteria.

SERIES 2.

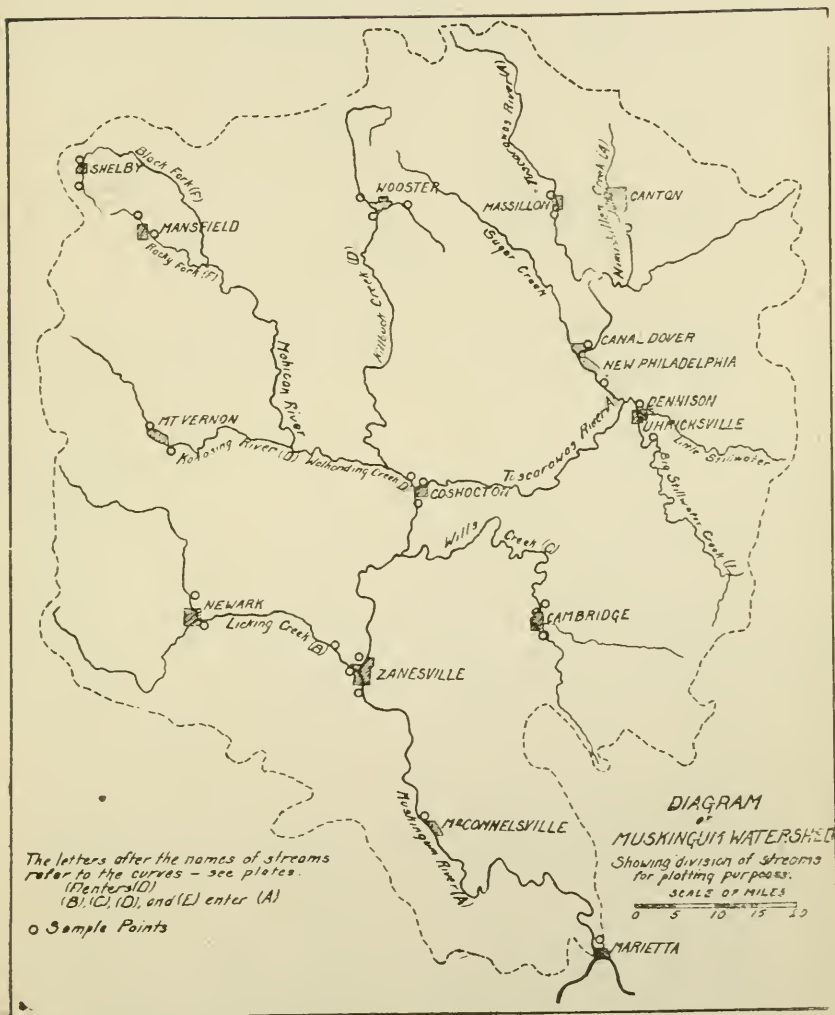
Curves B, C, and E. B, LICKING Creek; C, WILLS Creek; E, BIG STILLWATER Creek.

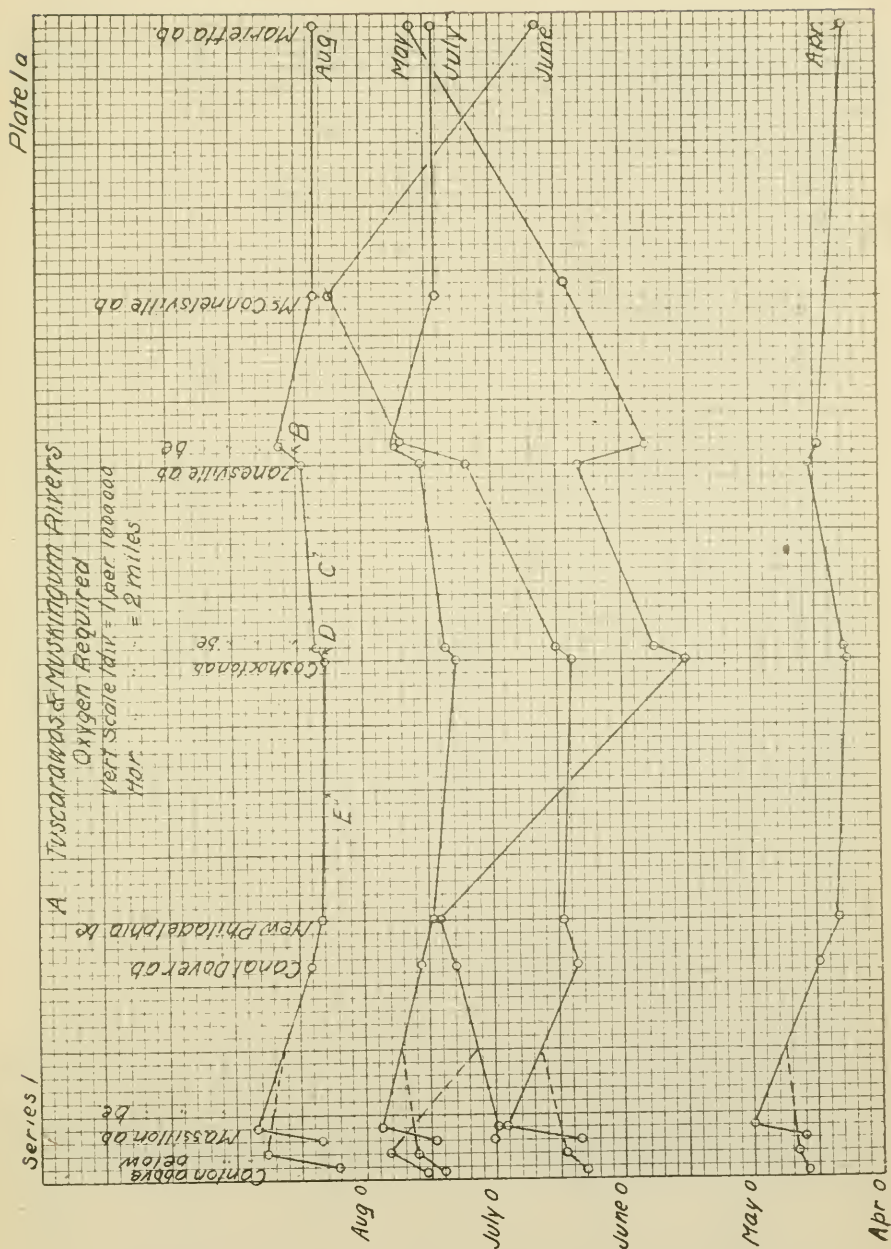
- 12 and 12a. Oxygen required.
- 13 and 13a. Albuminoid ammonia.
- 14 and 14a. Free ammonia.
- 15. Nitrites.
- 16. Nitrates.
- 17. Chlorine.
- 18. Incrusting constituents.
- 19 and 19a. Alkalinity.
- 20 and 20a. Total solids.
- 21 and 21a. Bacteria.
- 22. Dissolved Oxygen.

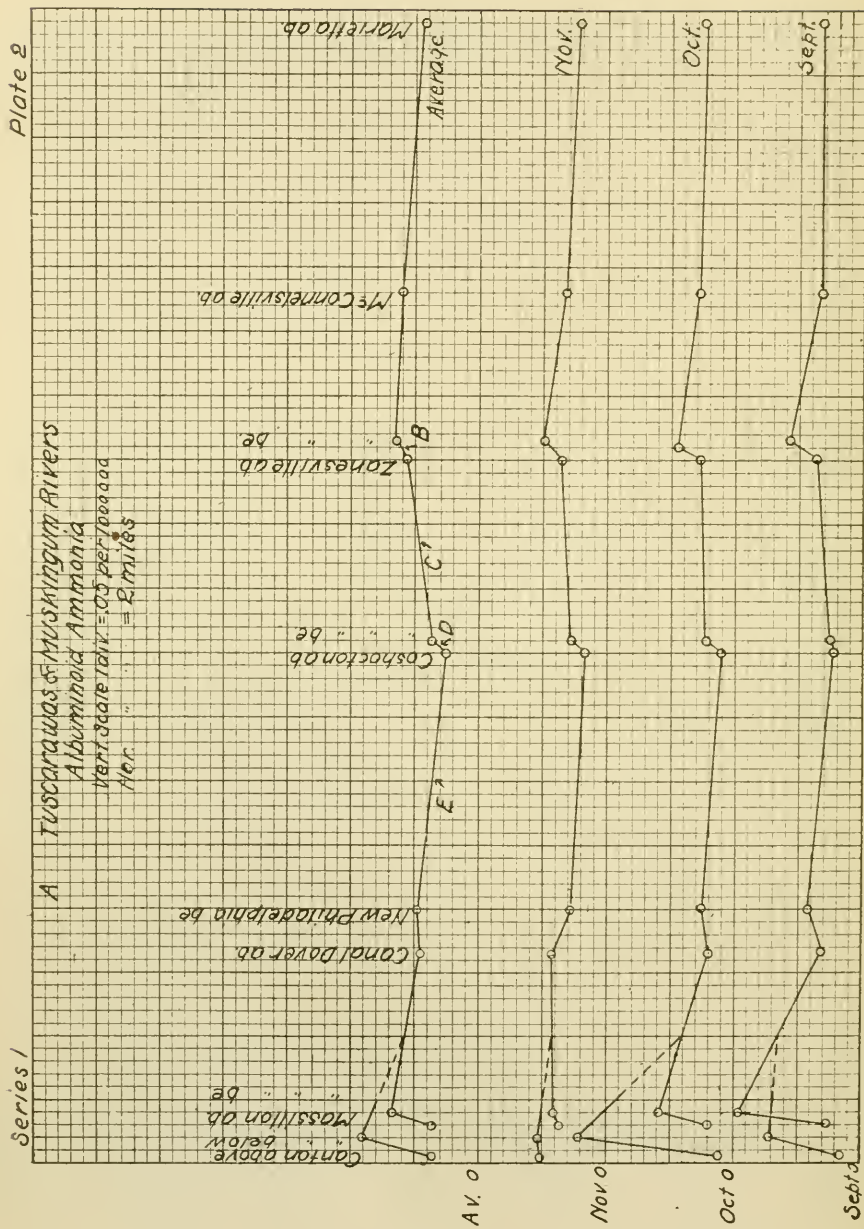
SERIES 3.

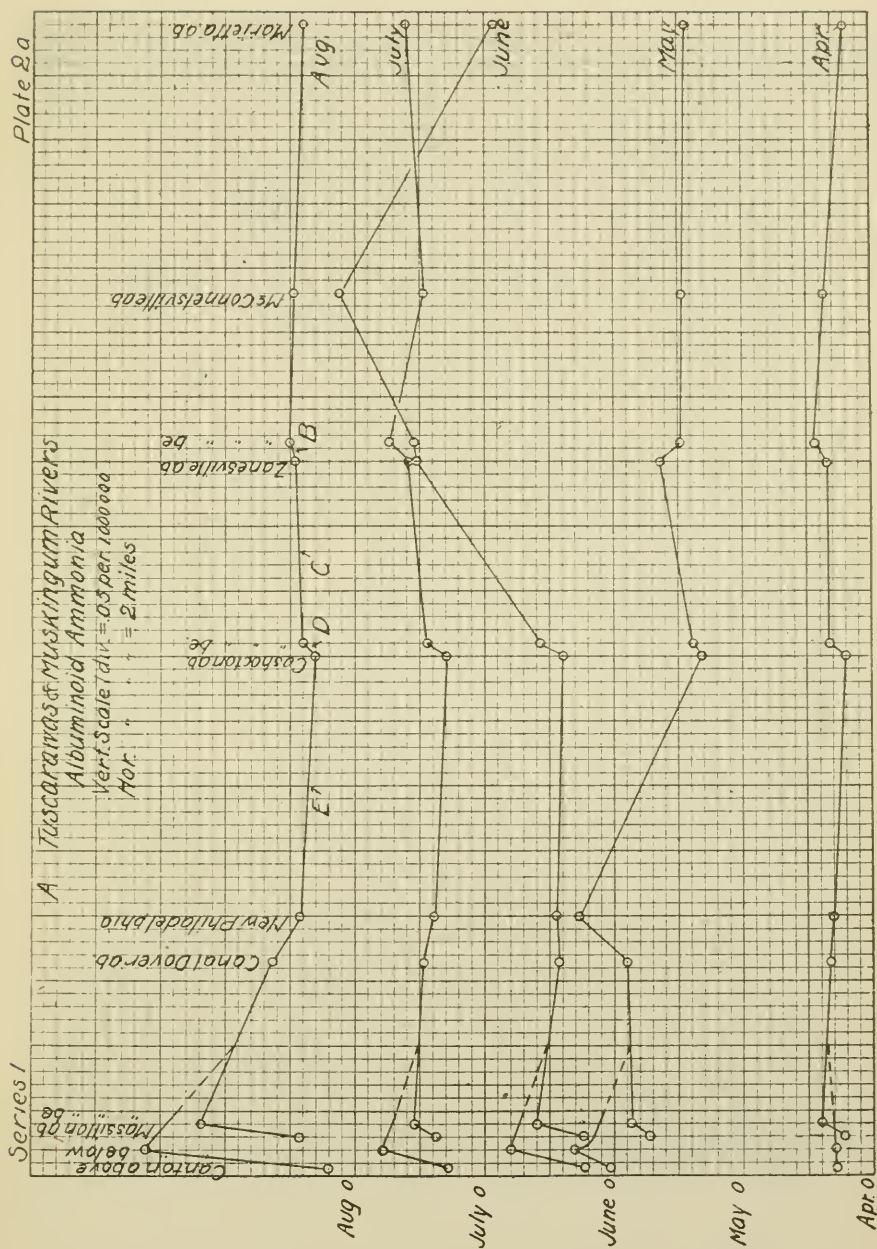
Curves D and F. D, KOKOSING River, APPLE, KILLBUCK and WALHONDING Creeks; F, BLACK and ROCKY FORKS of MOHICAN River.

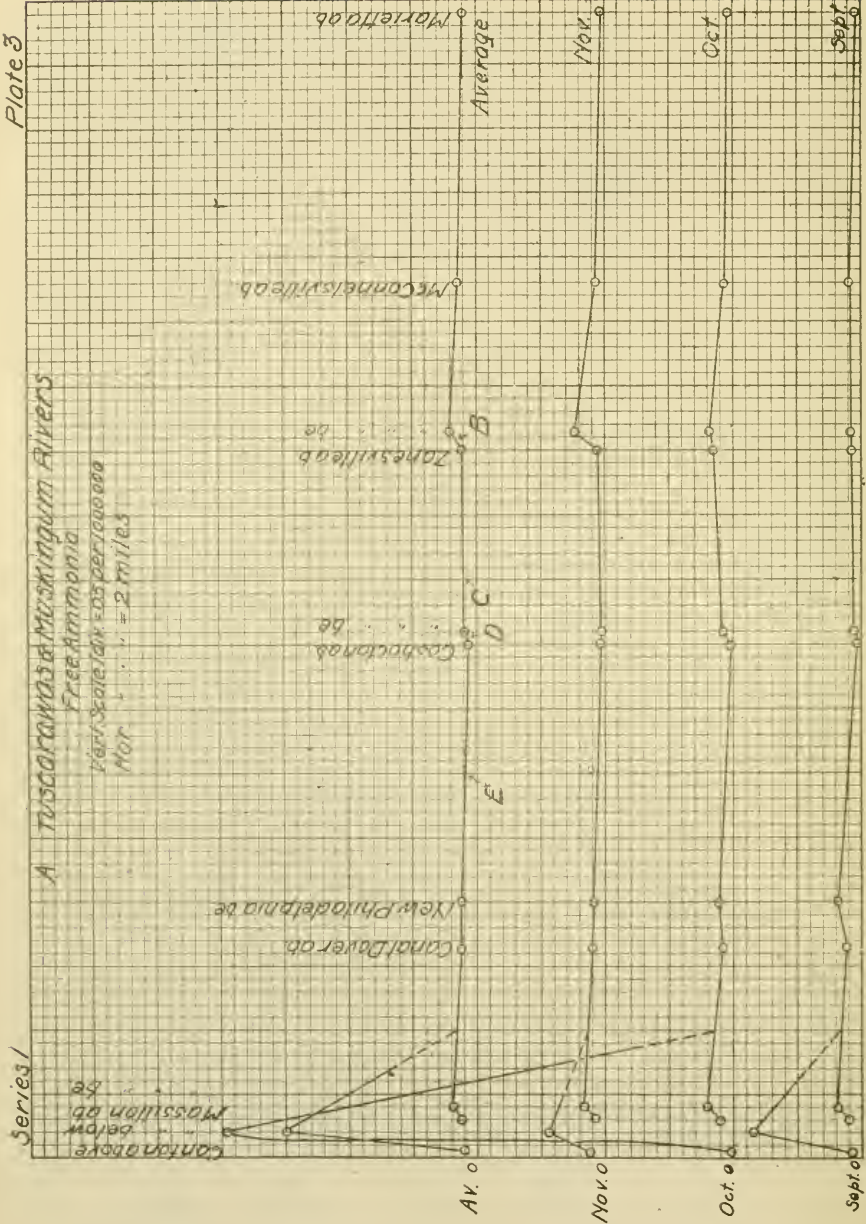
- 23. Dissolved oxygen.
- 24 and 24a. Oxygen required.
- 25 and 25a. Albuminoid ammonia.
- 26 and 26a. Free ammonia.
- 27. Nitrites.
- 28. Nitrates.
- 29 and 29a. Chlorine.
- 30 and 30a. Alkalinity.
- 31 and 31a. Total solids.
- 32 and 32a. Bacteria.
- 33. Incrusting constituents.

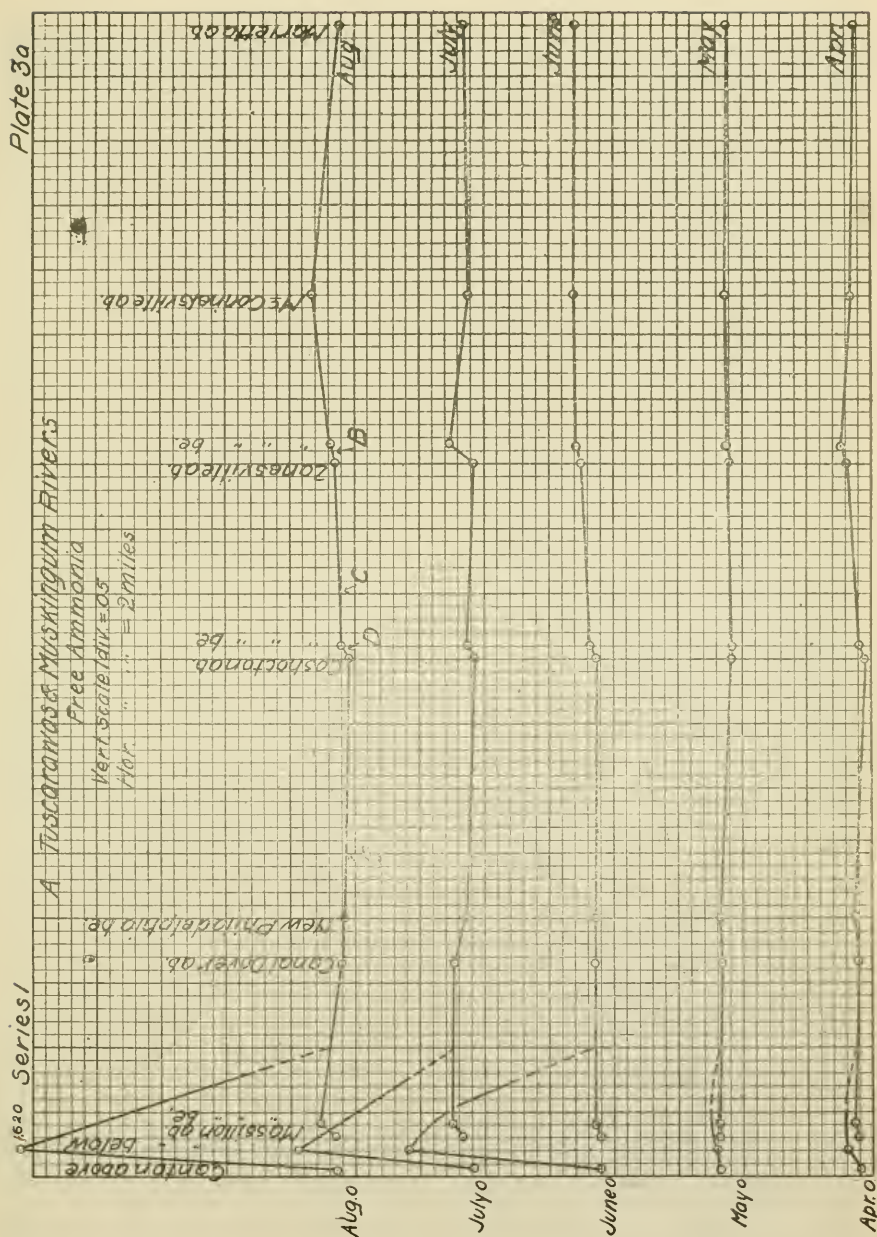


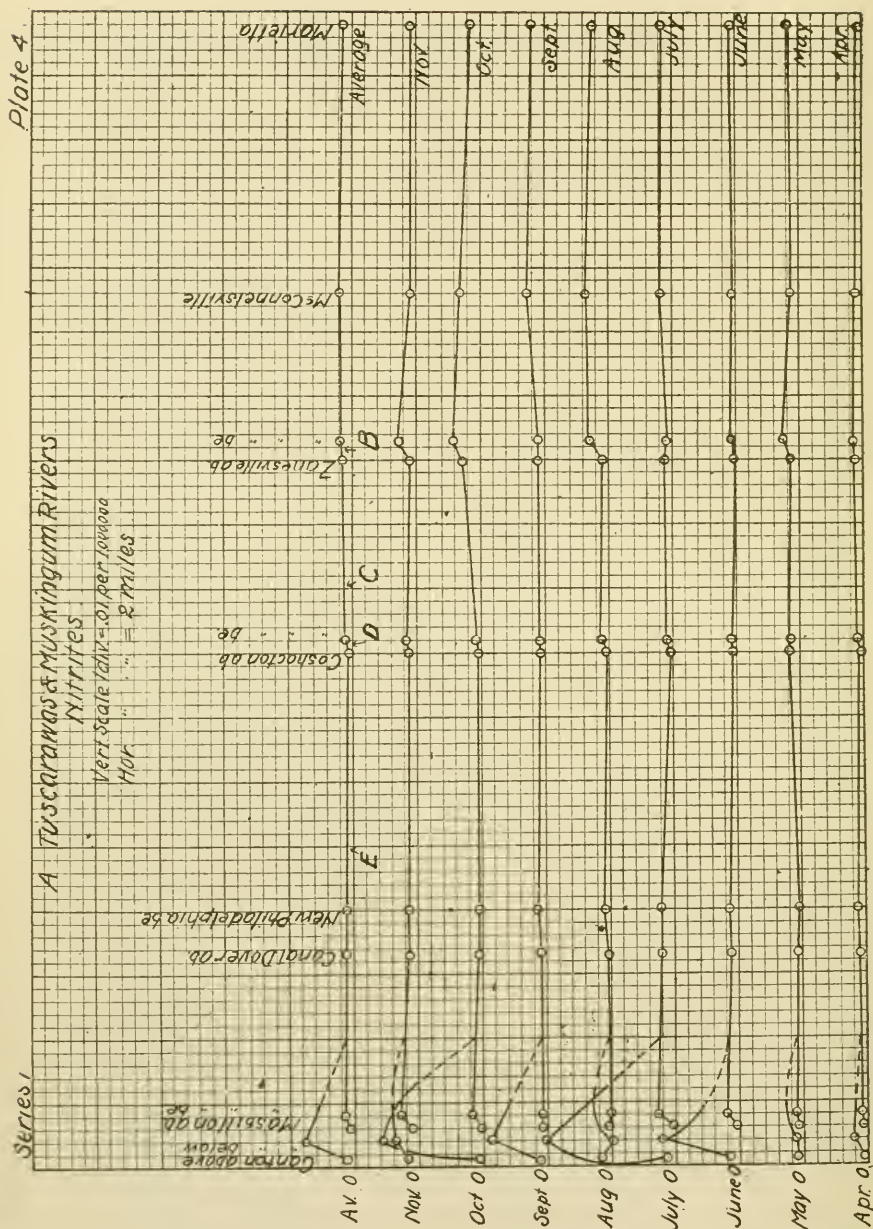


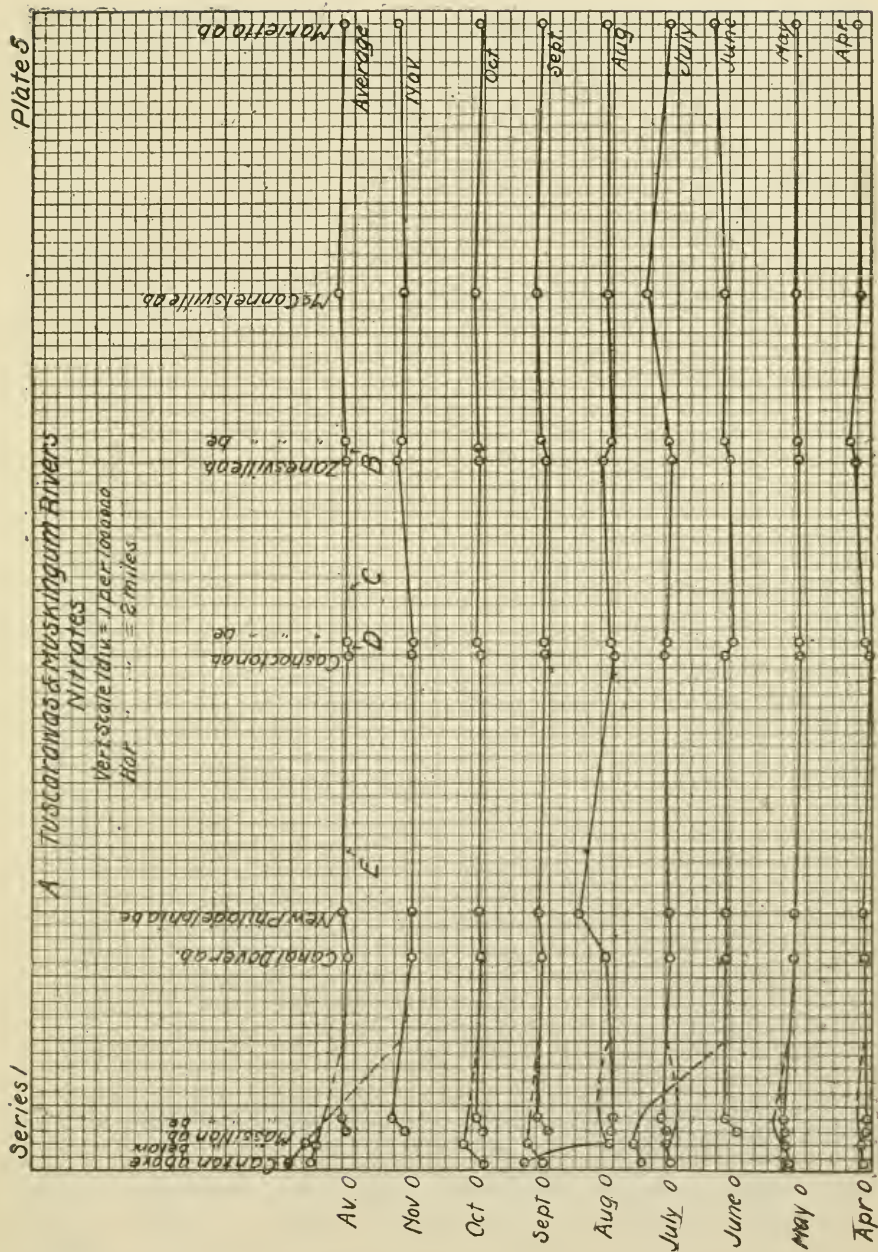


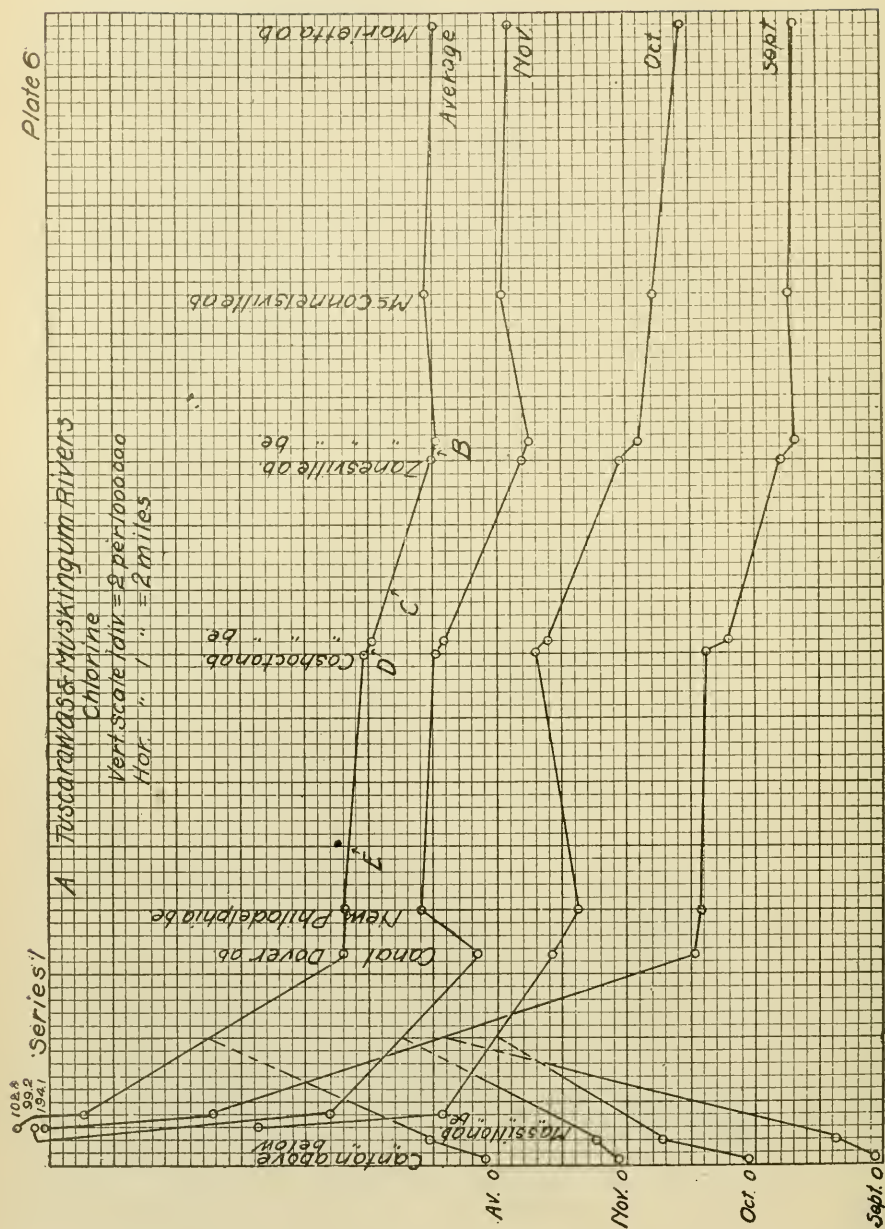


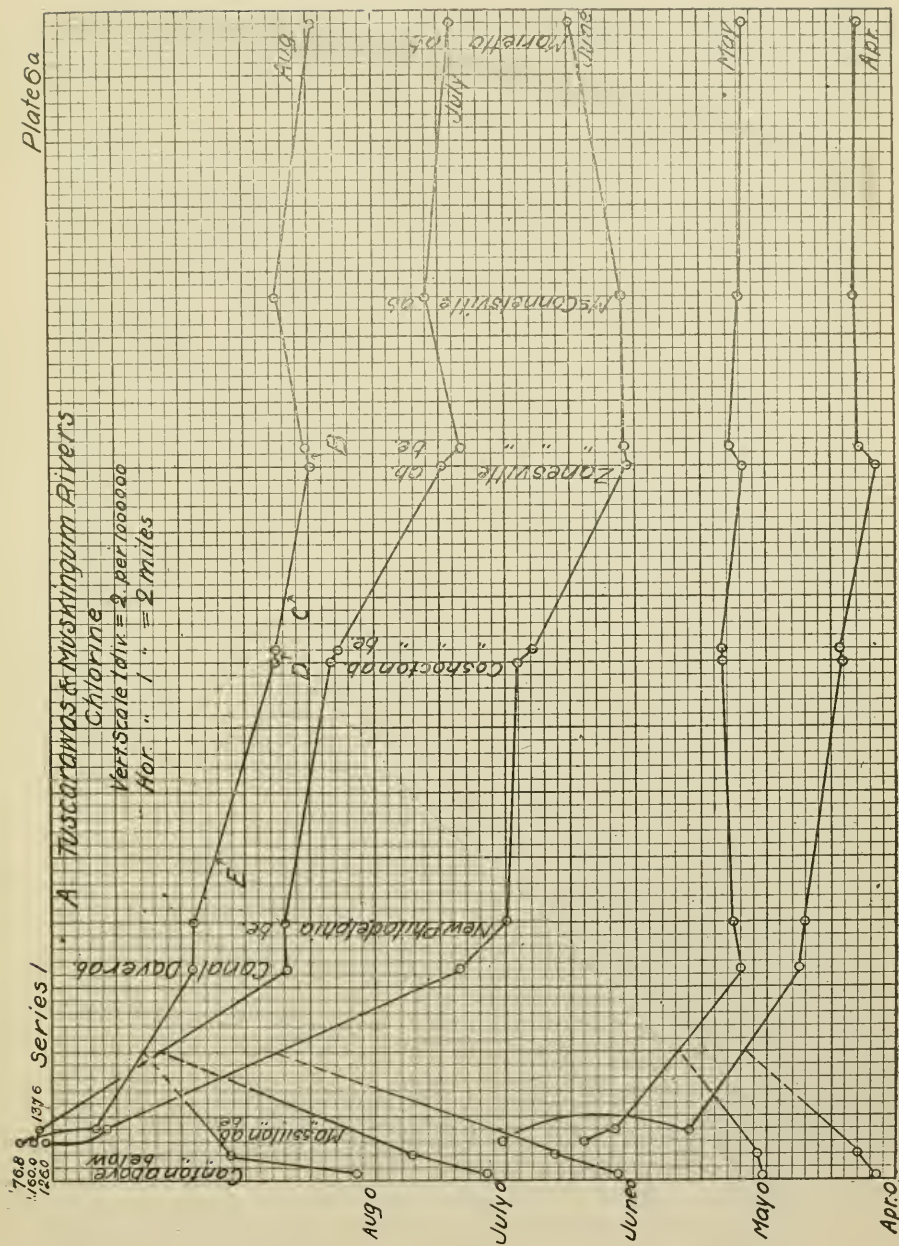


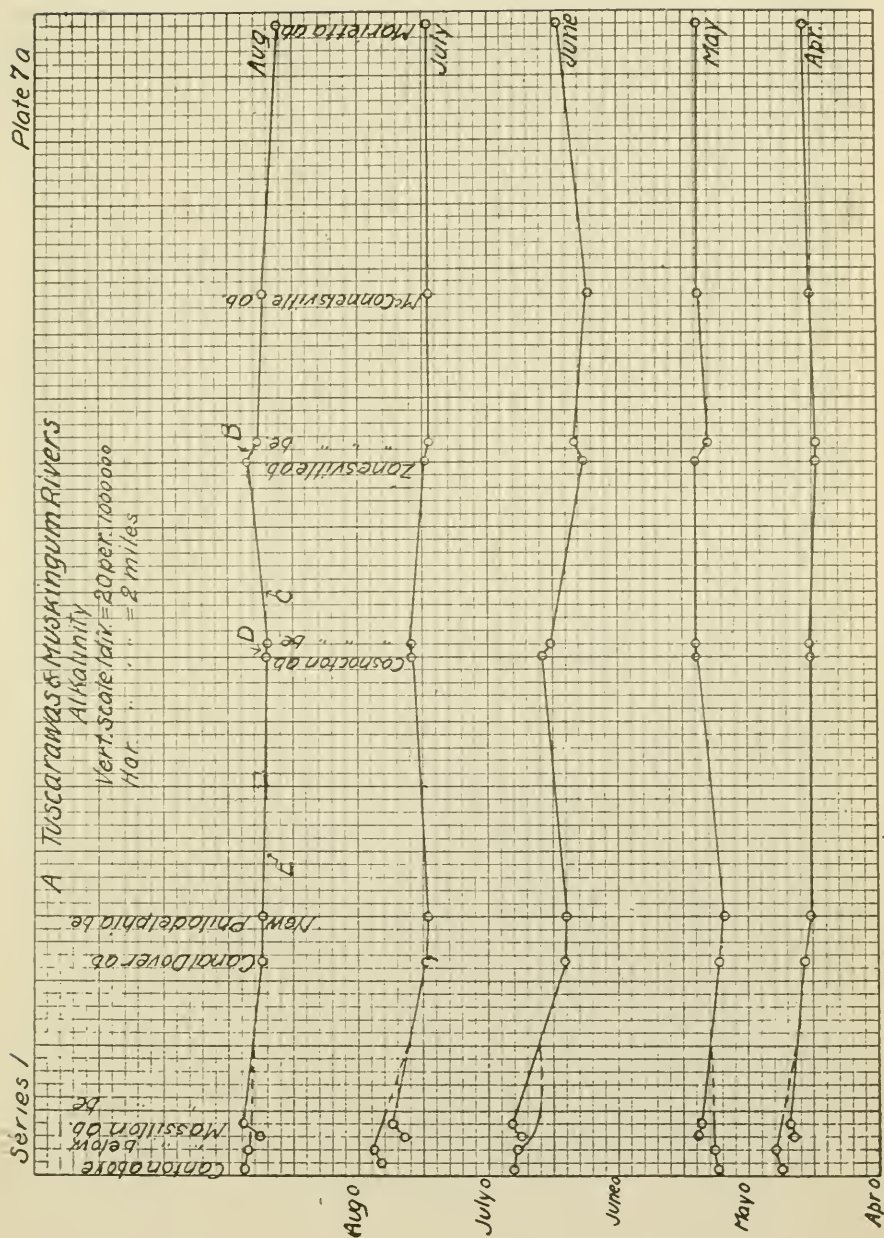


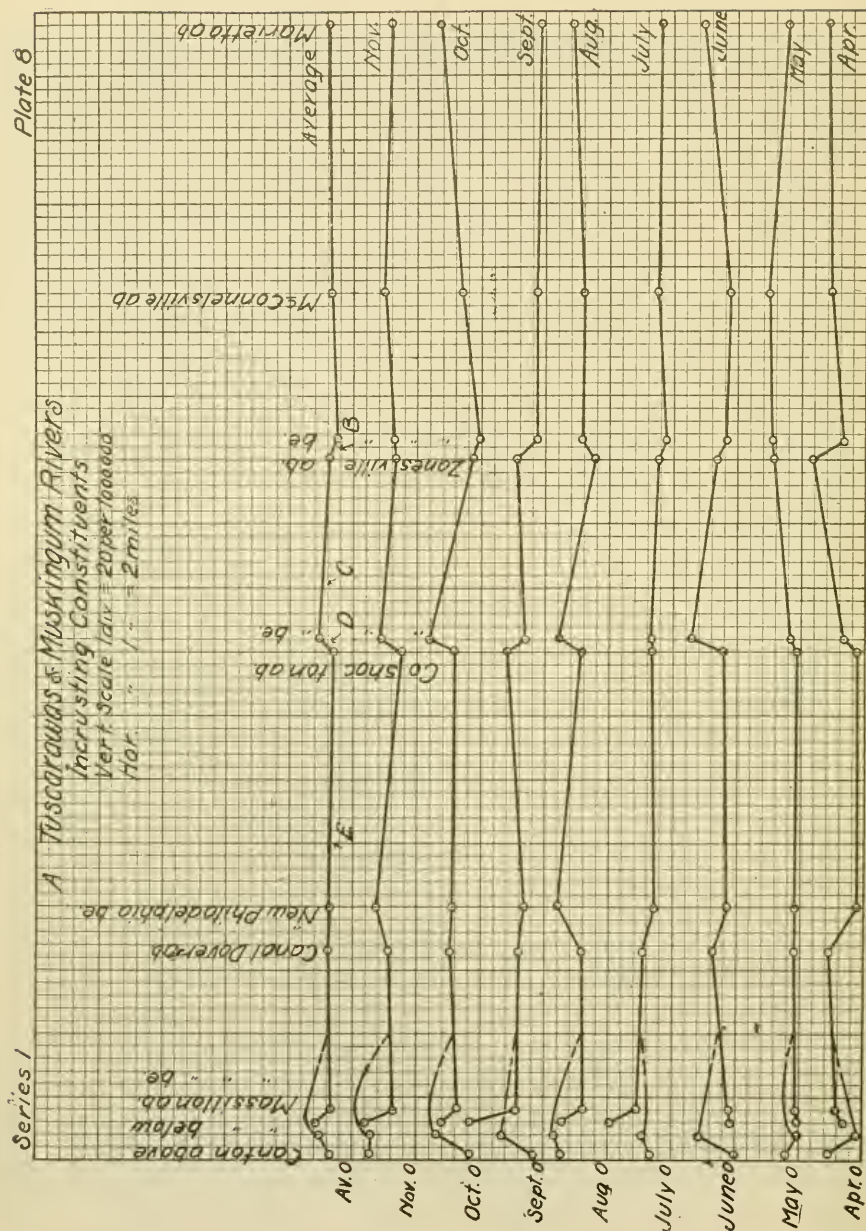


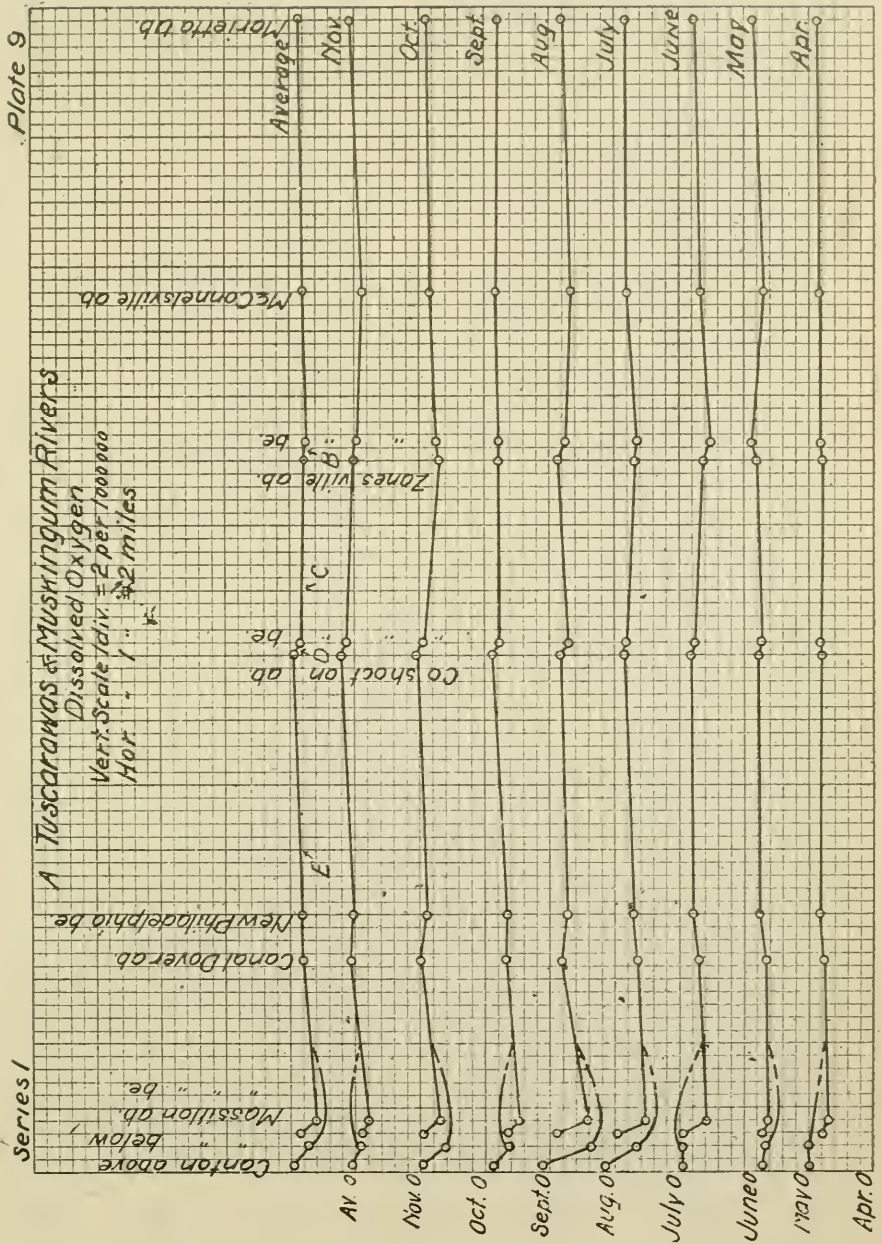


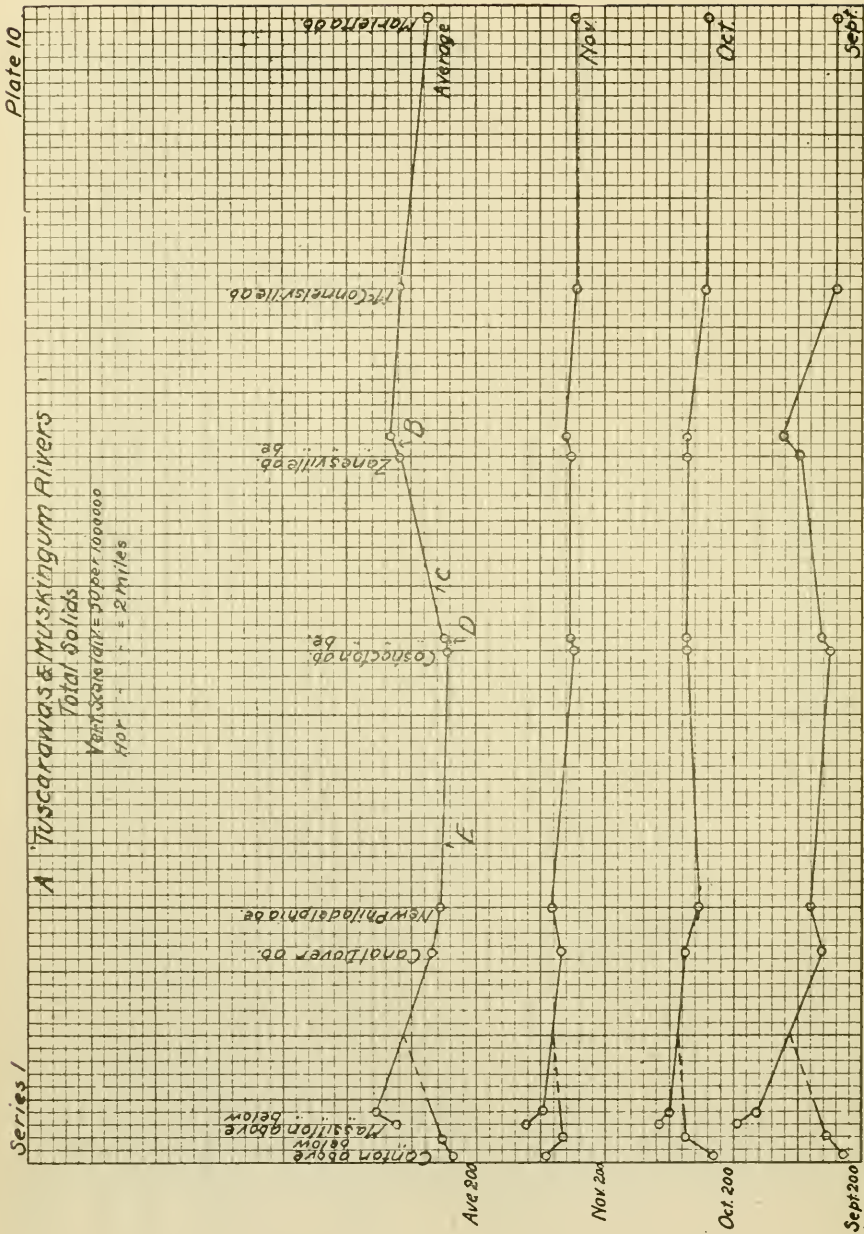


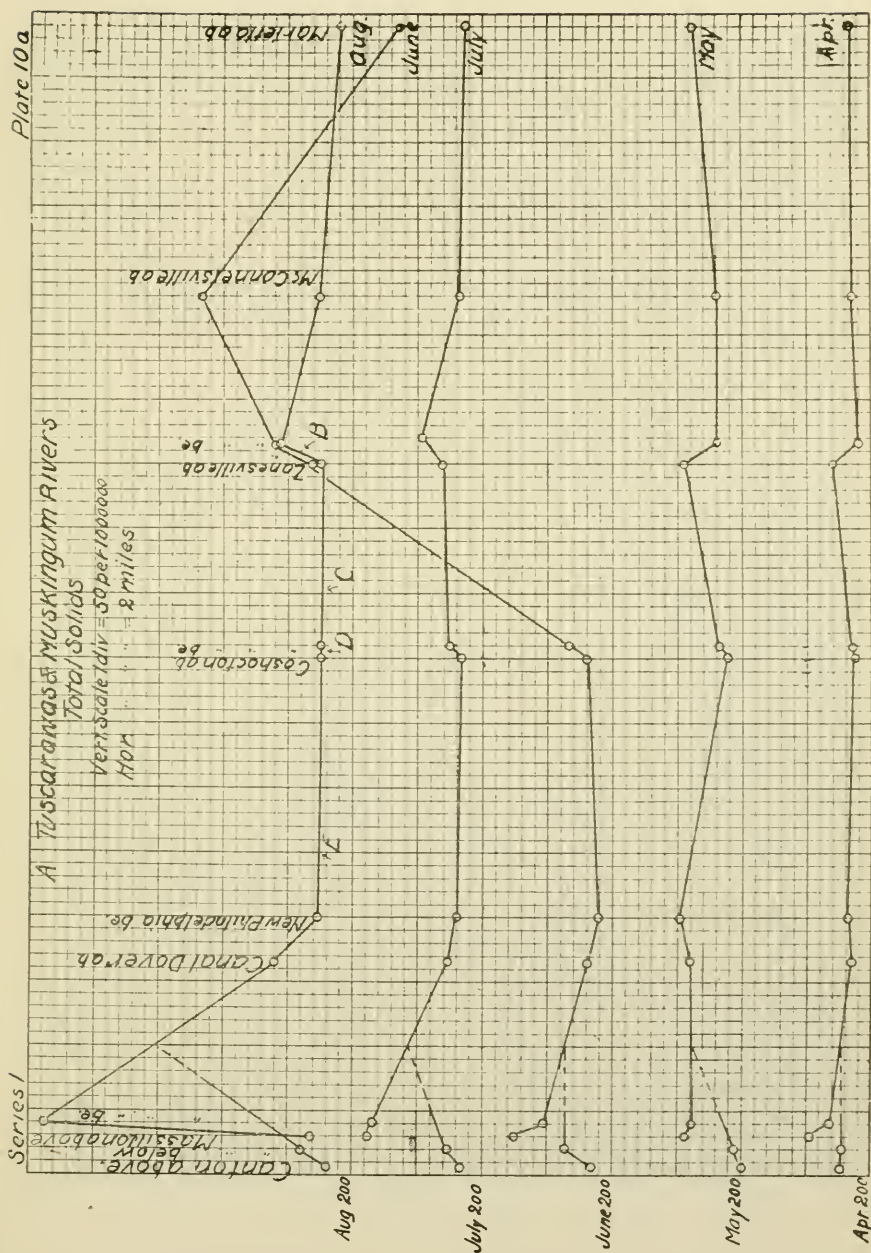


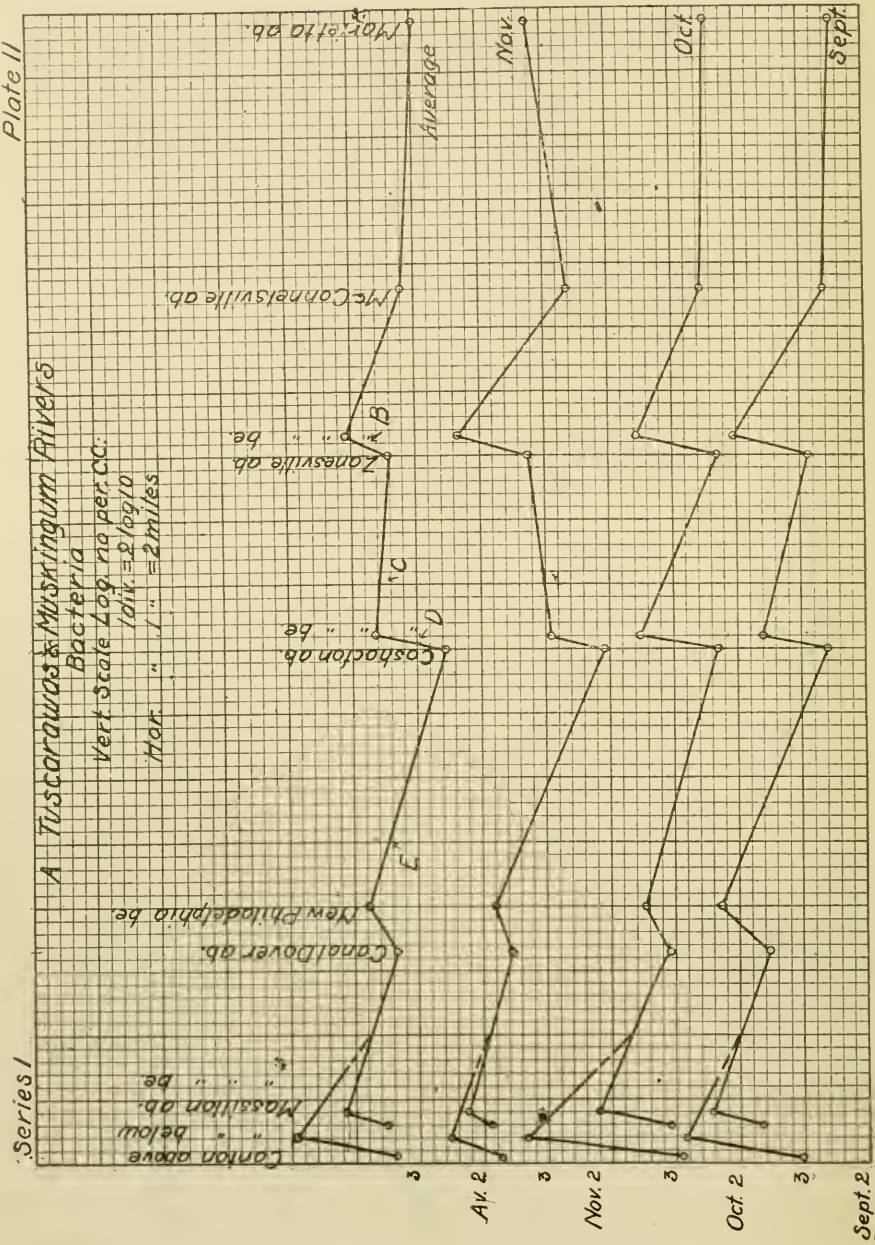


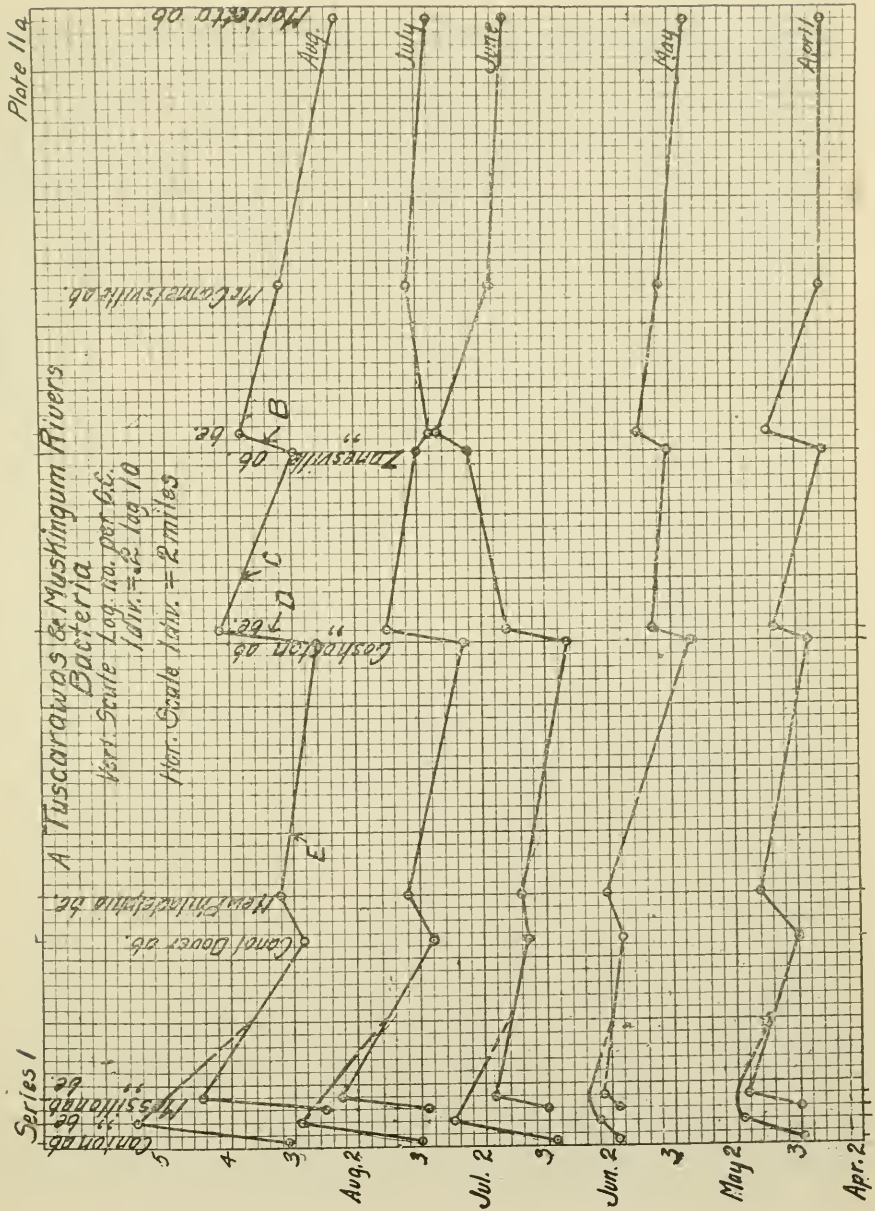


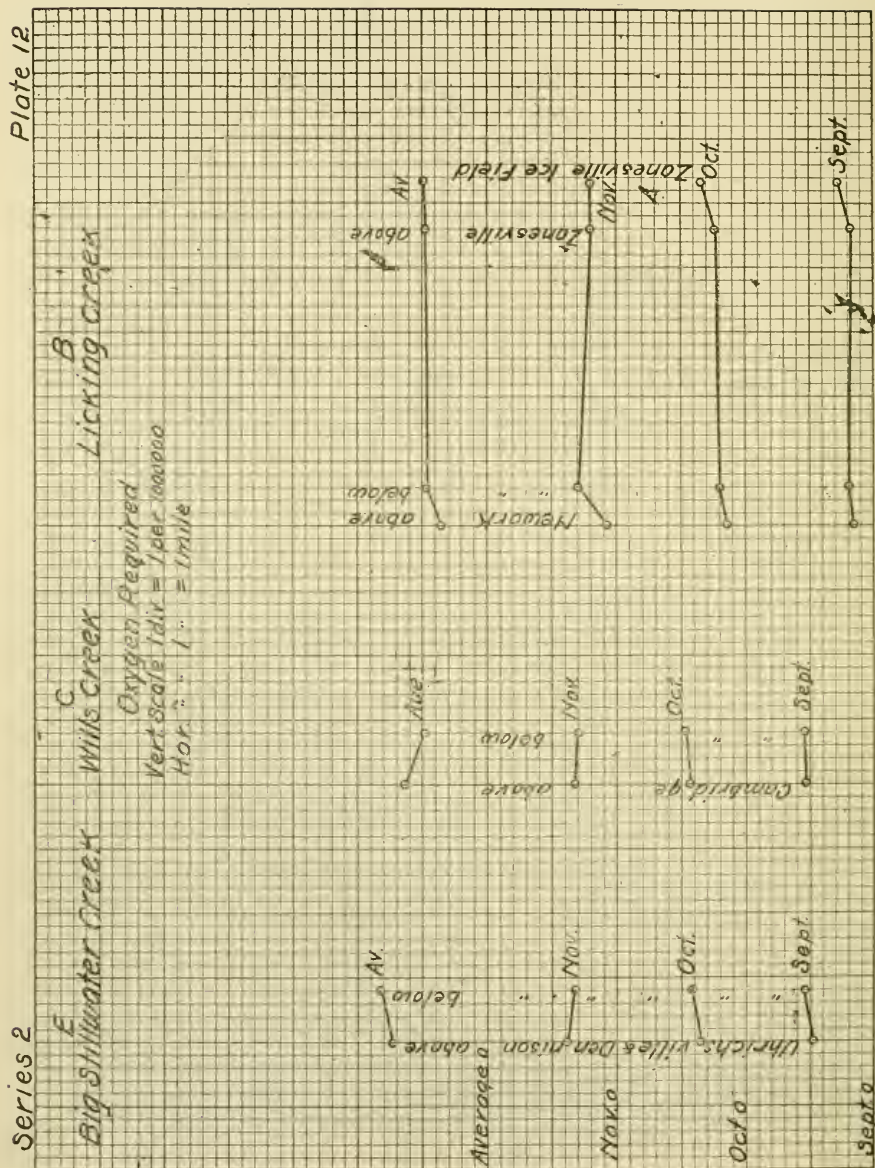


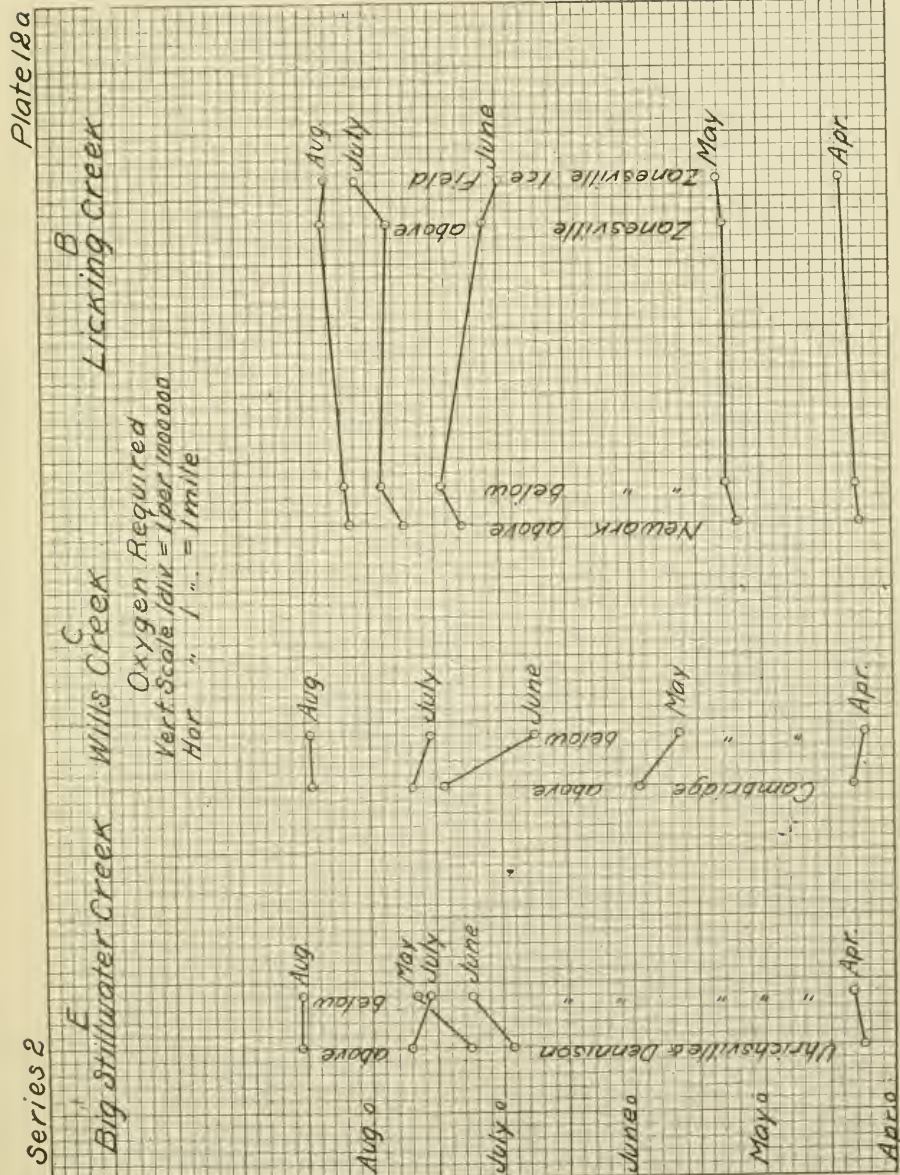












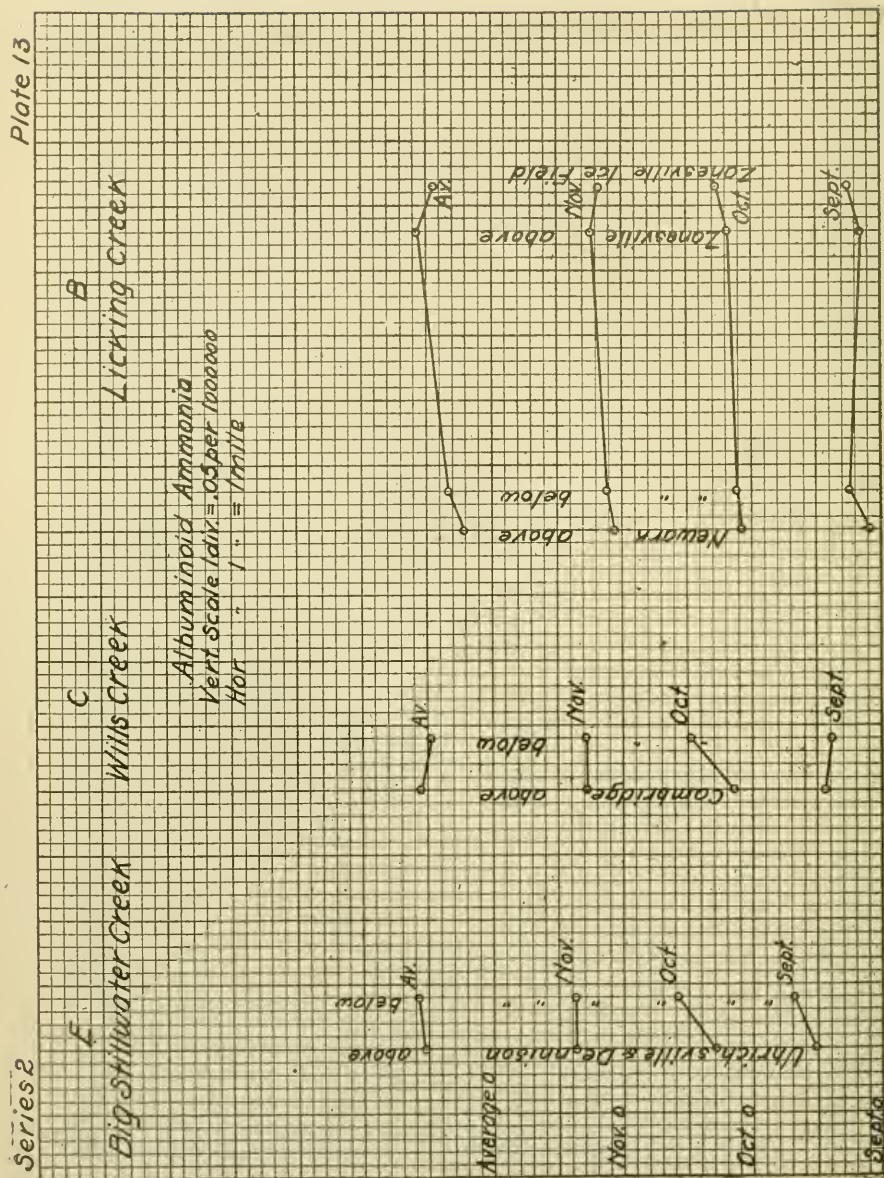
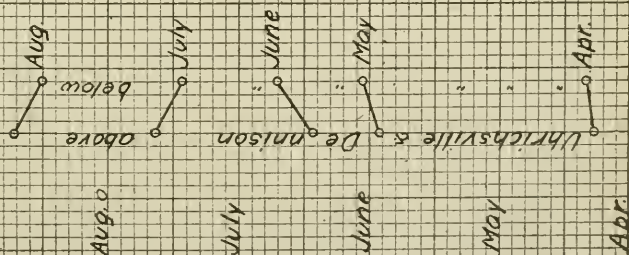


Plate 13a

Series 2

E

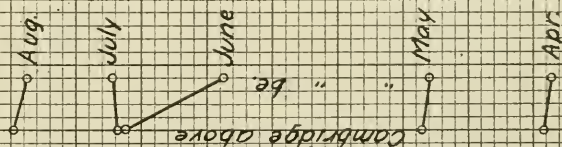
Big Stillwater Creek



C

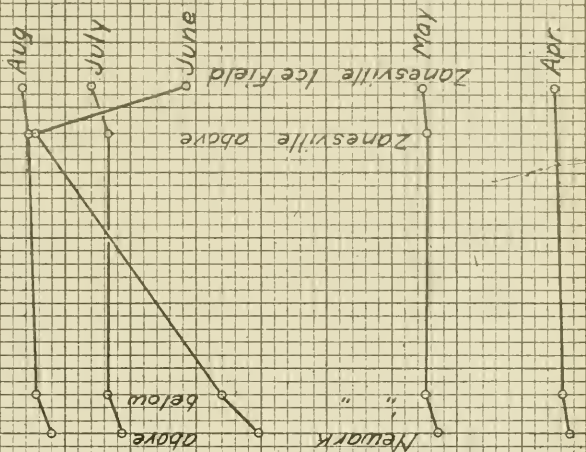
Will's Creek

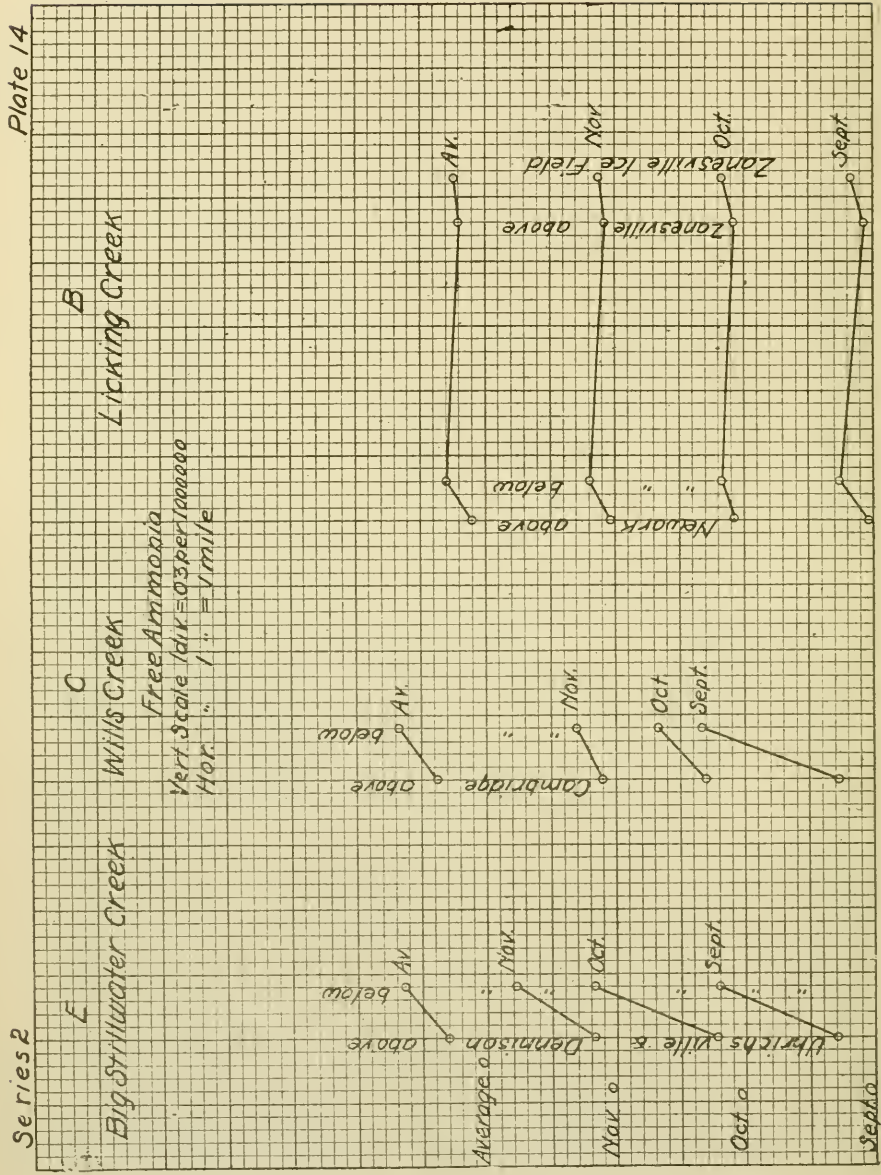
Albuminoid Ammonia
Vert. Scale 1 div = .05 per 1000000
Hor. " " " = 1 mile



B

Licking Creek





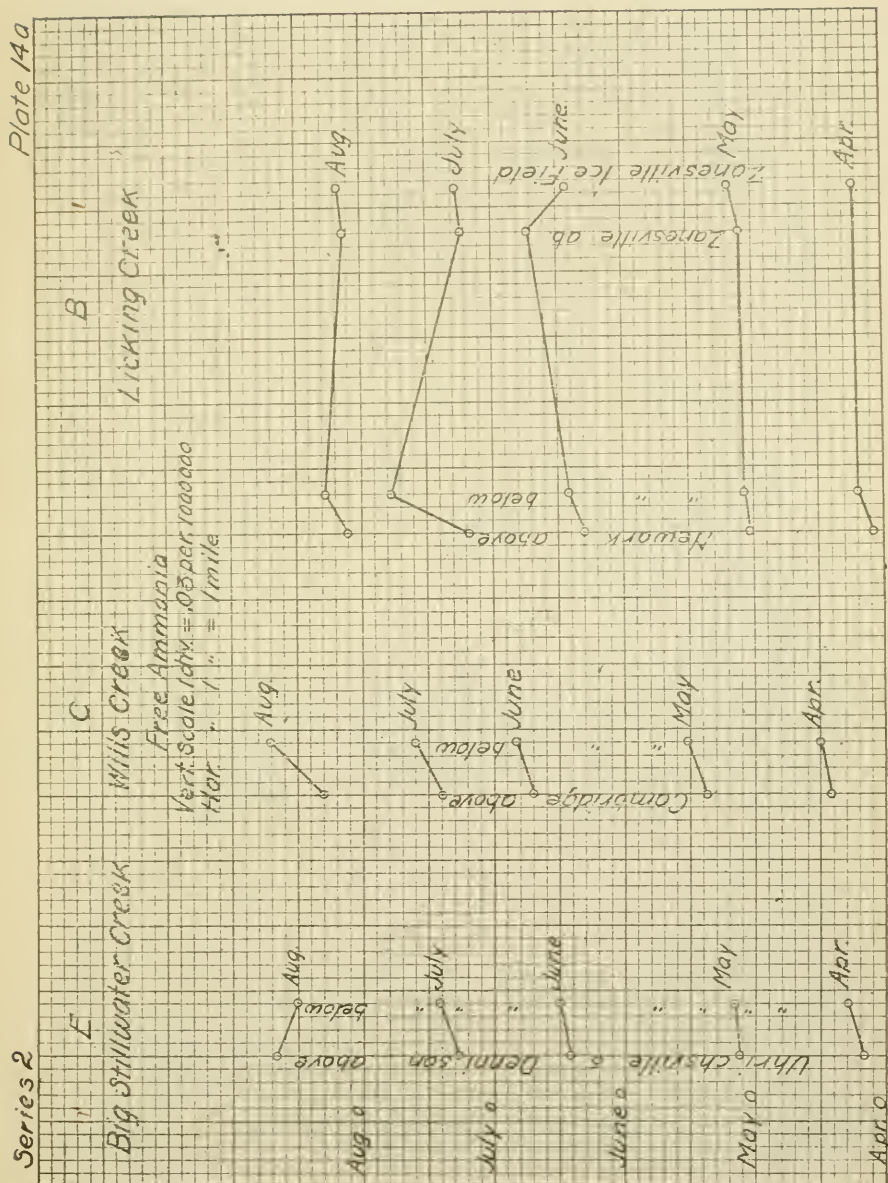
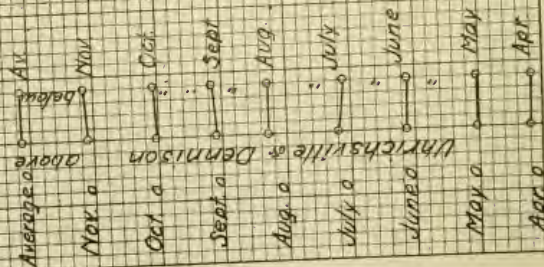


Plate 16

Series E

E

Big Springwater Creek



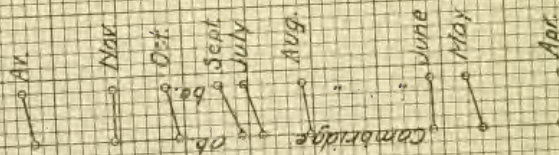
C

Wills Creek

Nitriles

Vert. Scale 1 div = 0.1 per 100000

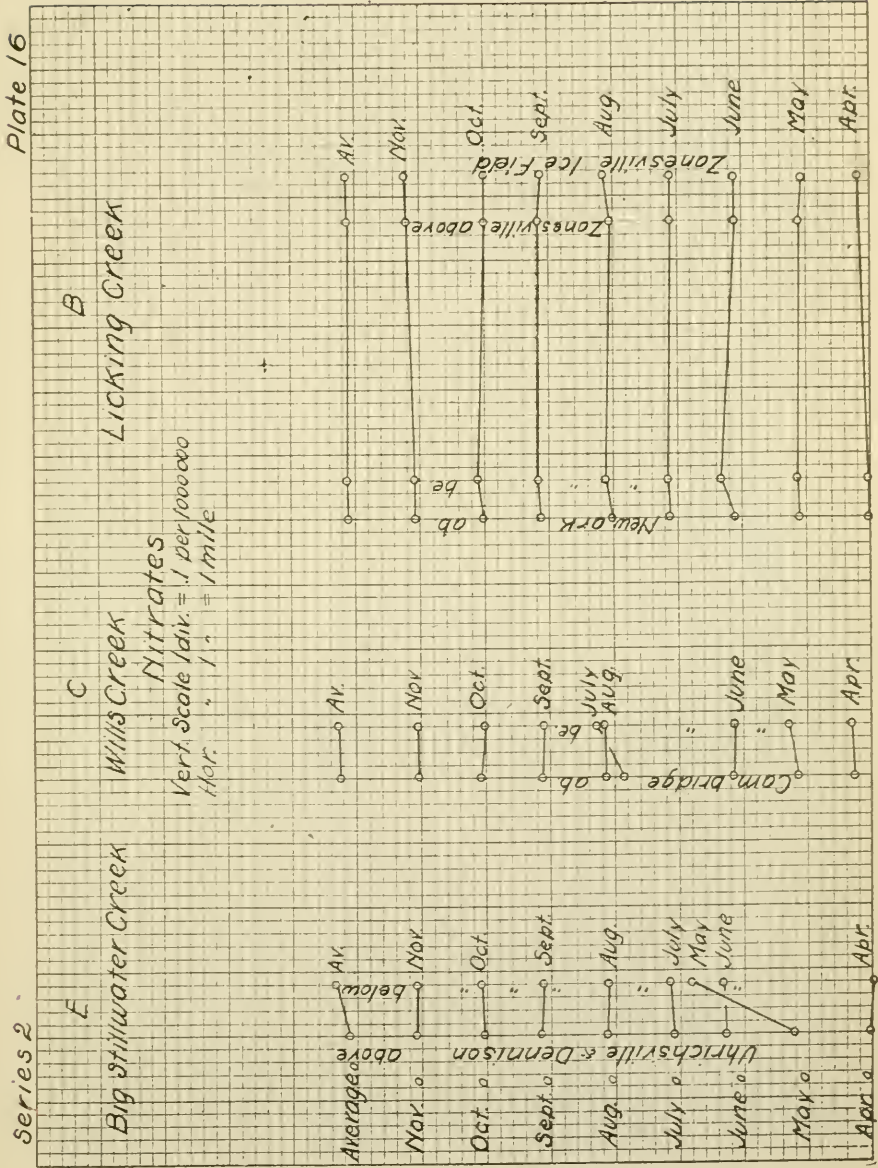
Hor. " 1 " = 1 mile

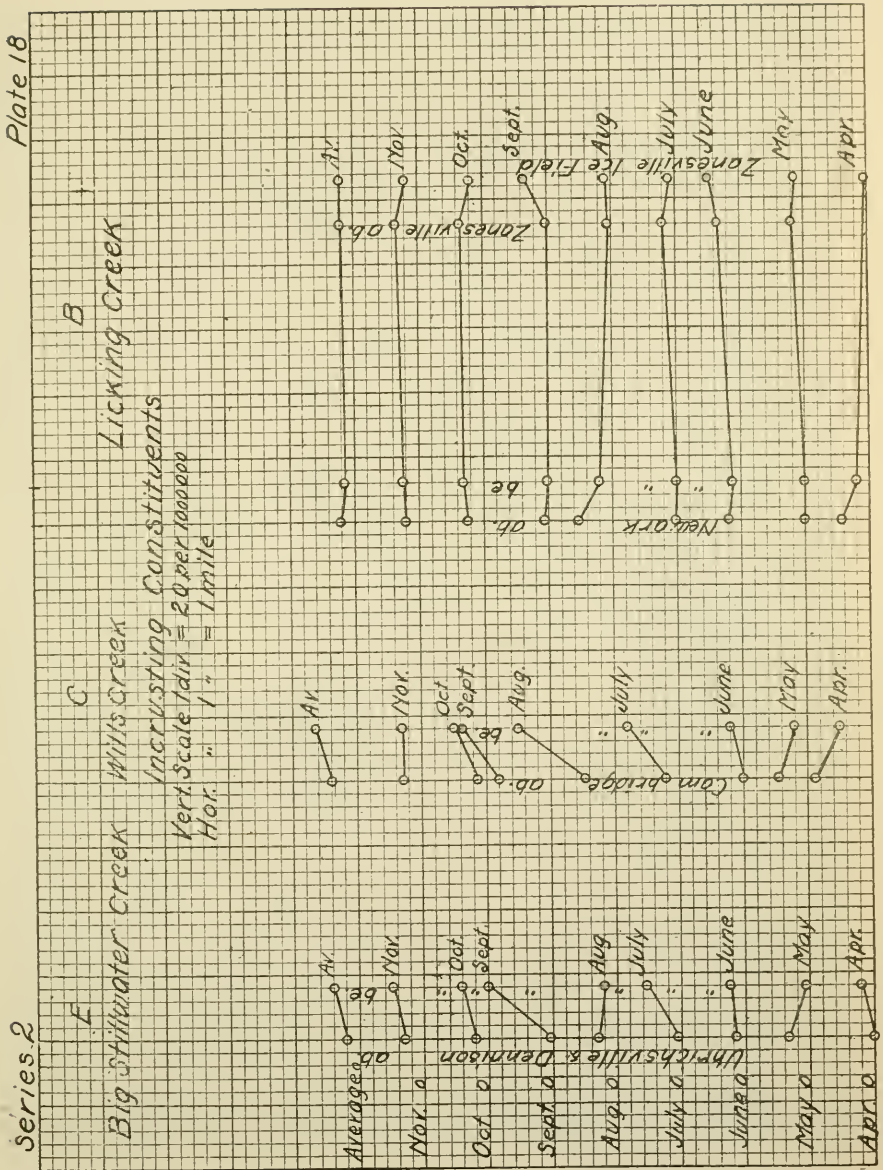


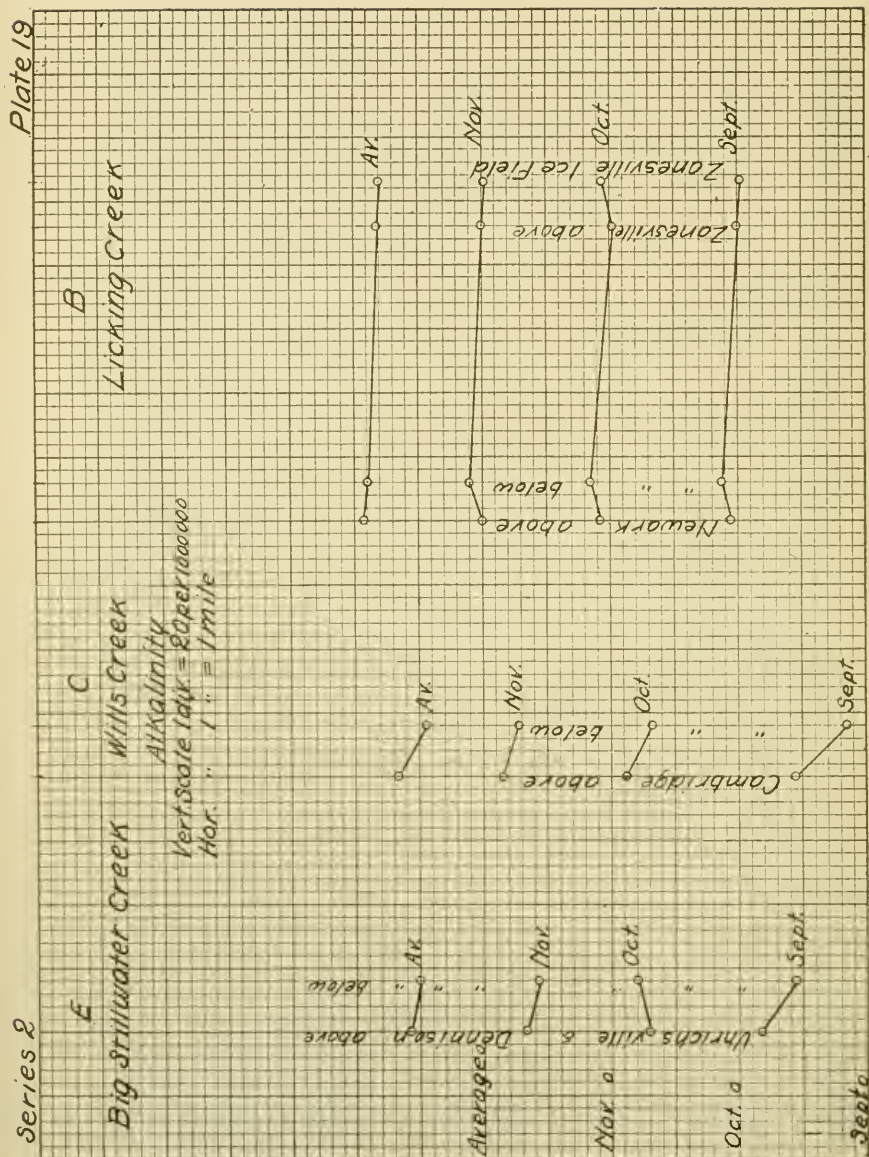
B

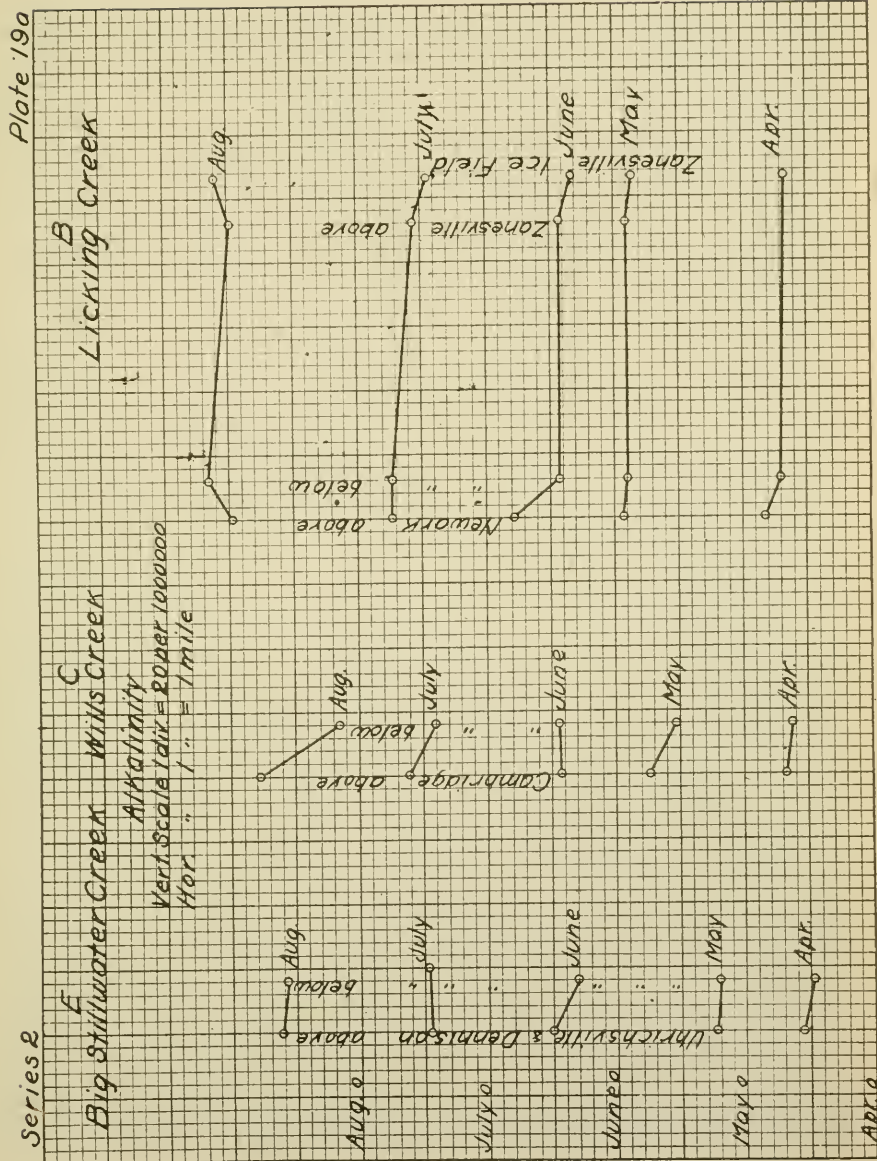
Licking Creek

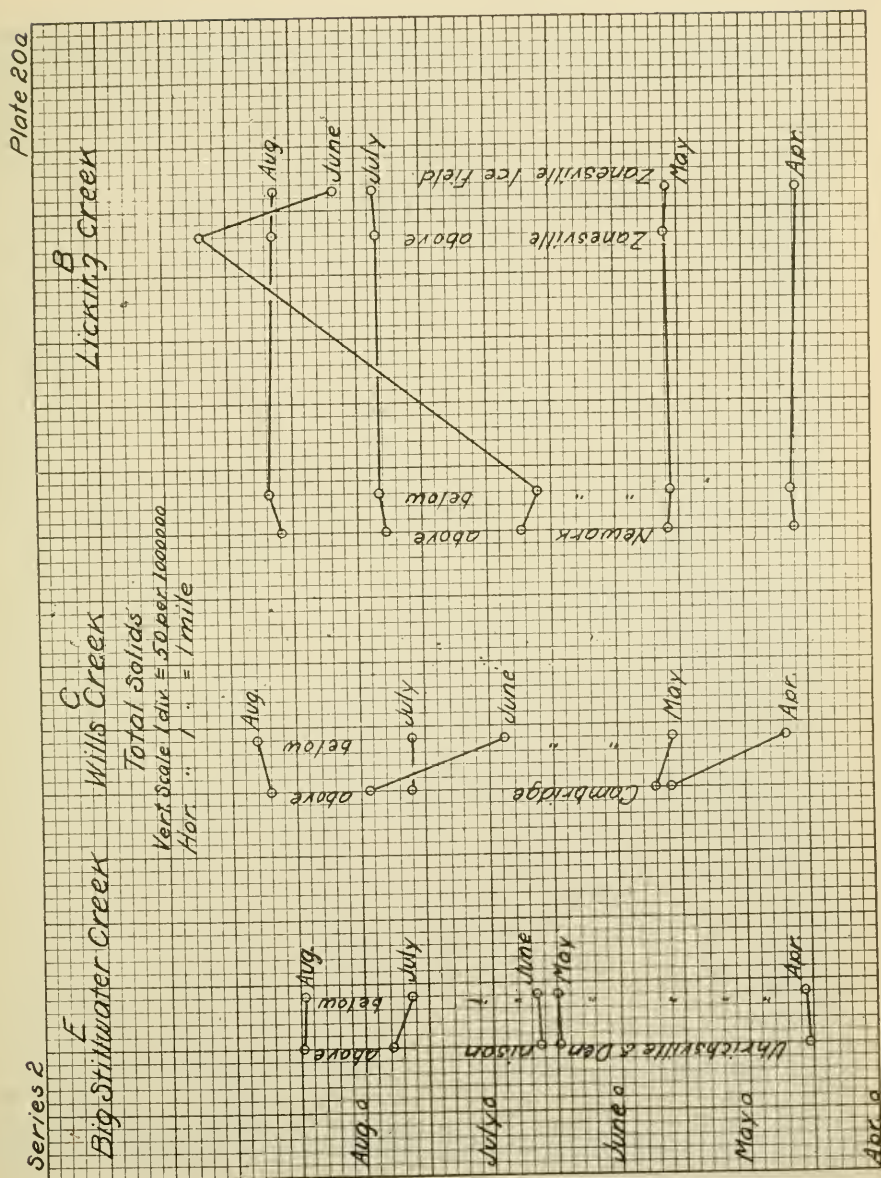












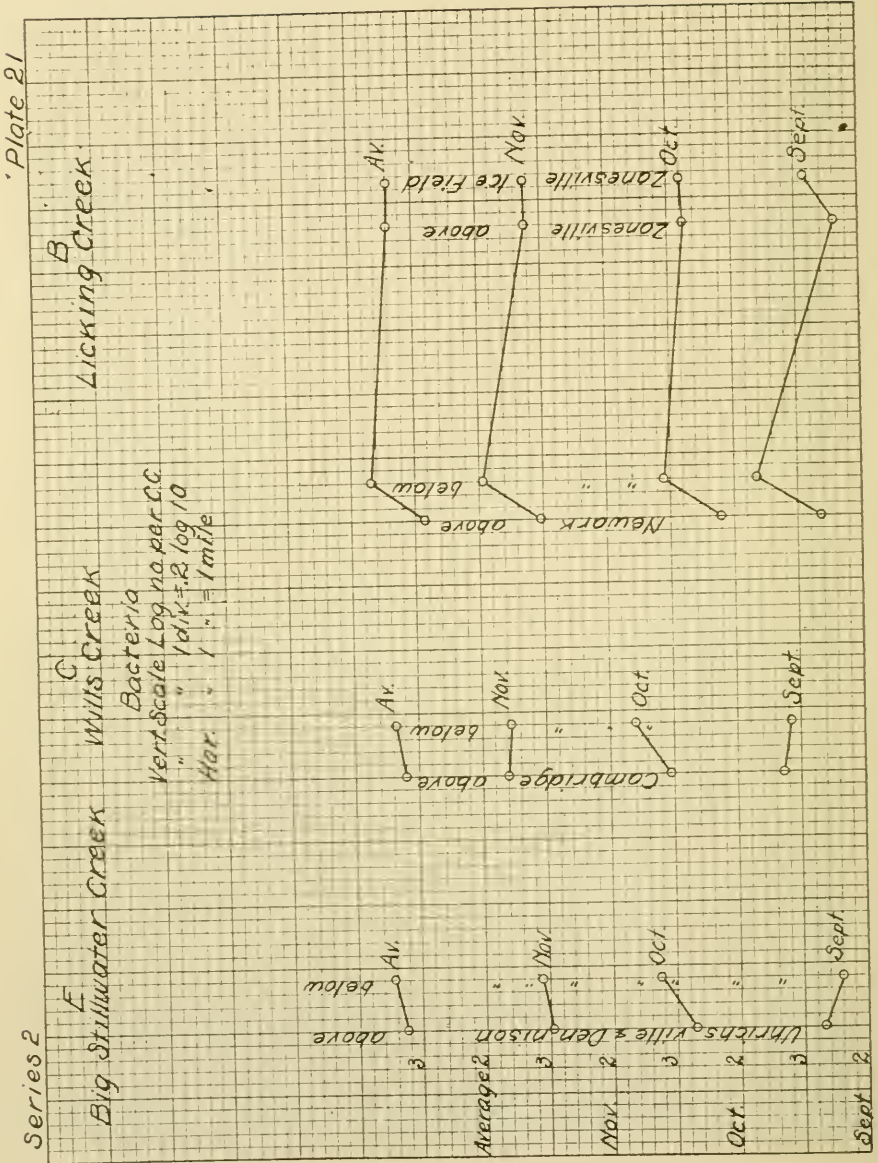


Plate 21a

Series 2

五

Big Stillwater Creek

6

Wills Creek

三

Licking Creek

Bacteria

Vert Scale Logger CC

" " " " " " $\log \frac{1}{\text{div}} = .2160$

Hor. " 1" = 1 miles

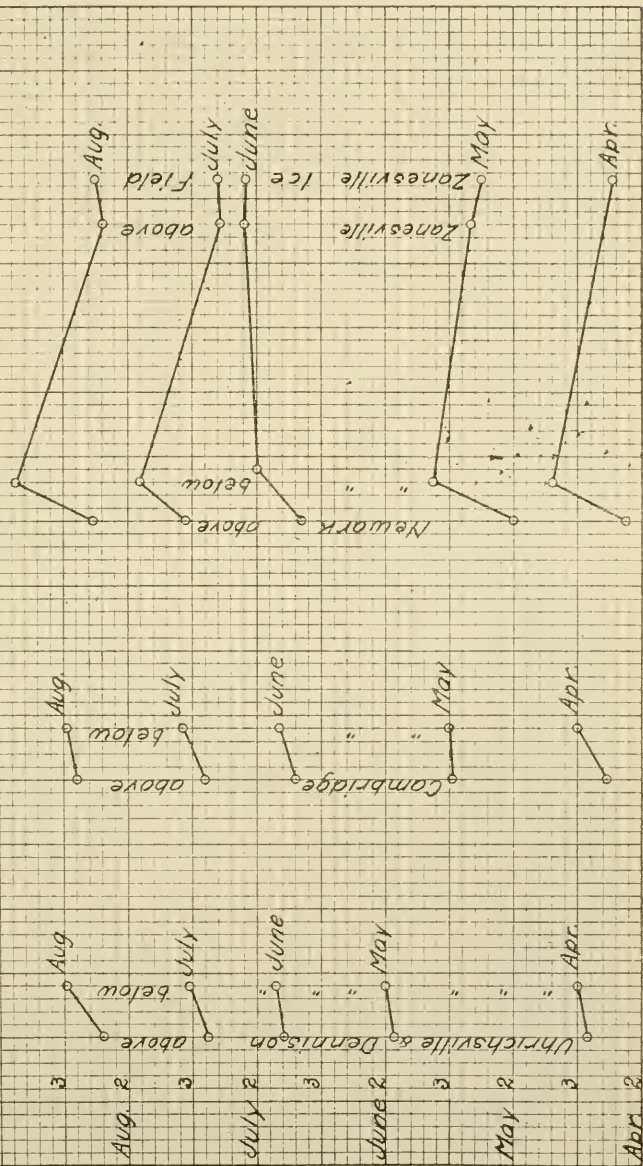
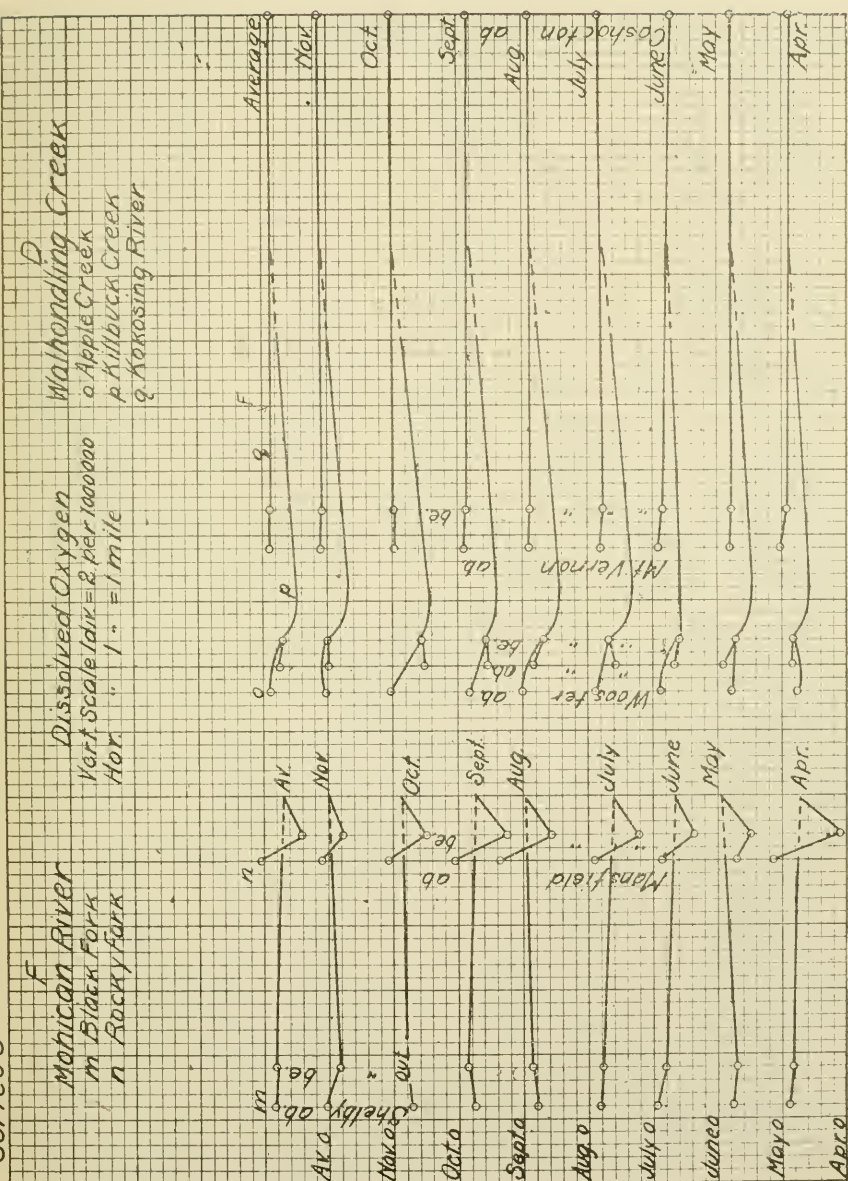
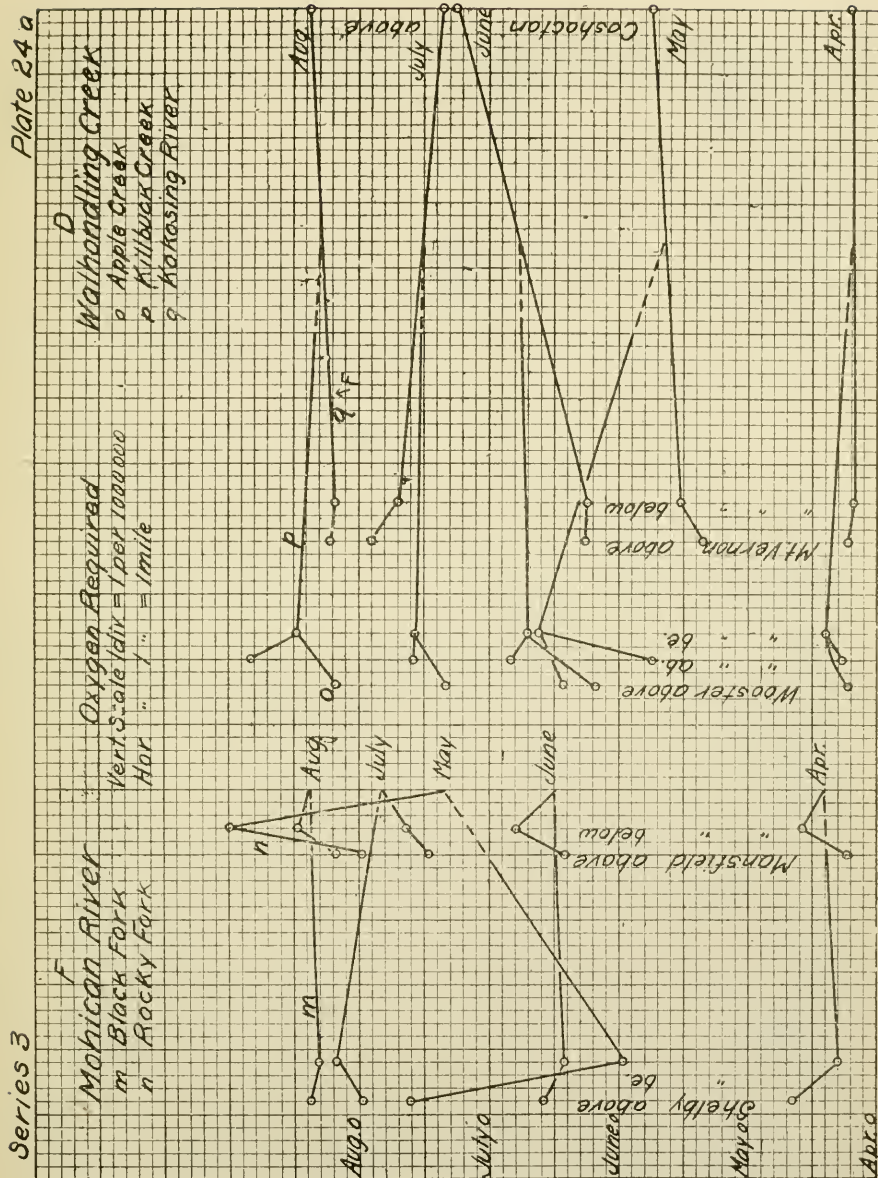
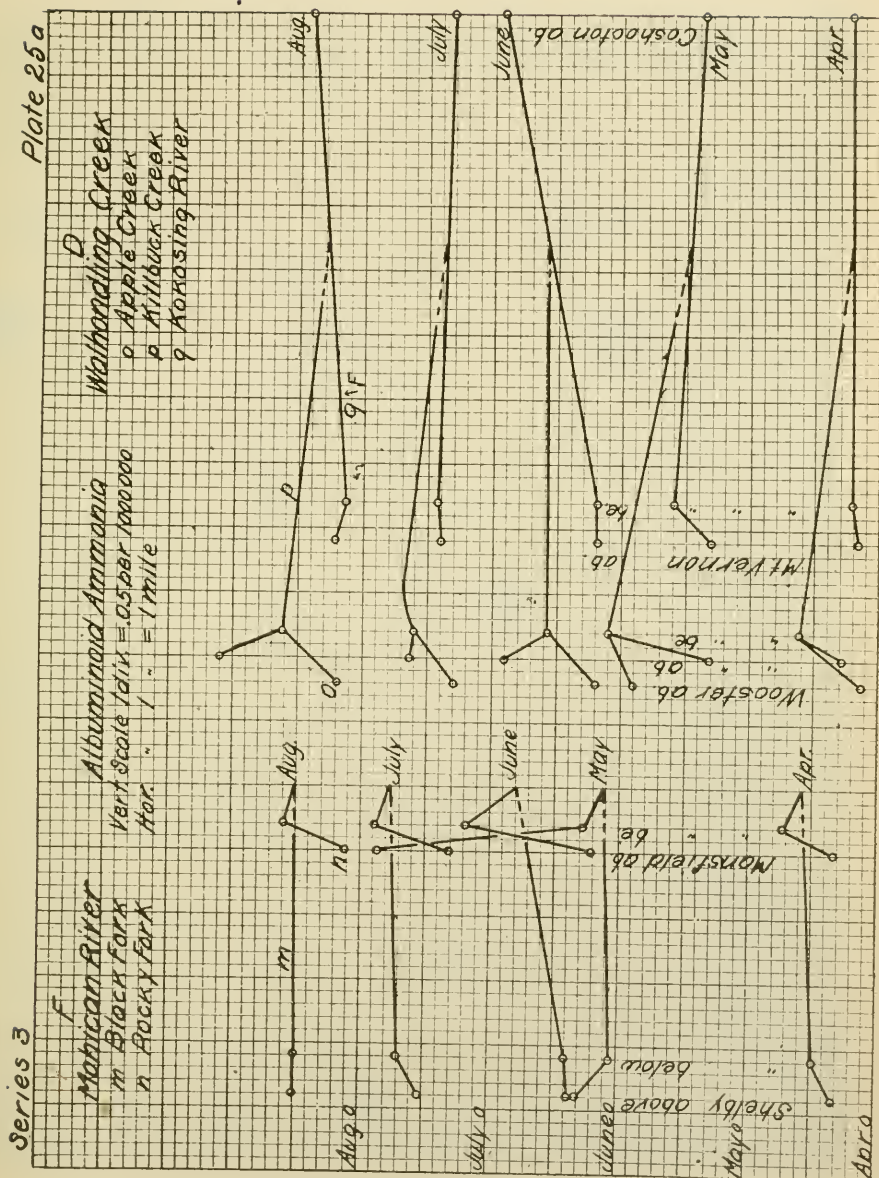


Plate 23

Series 3







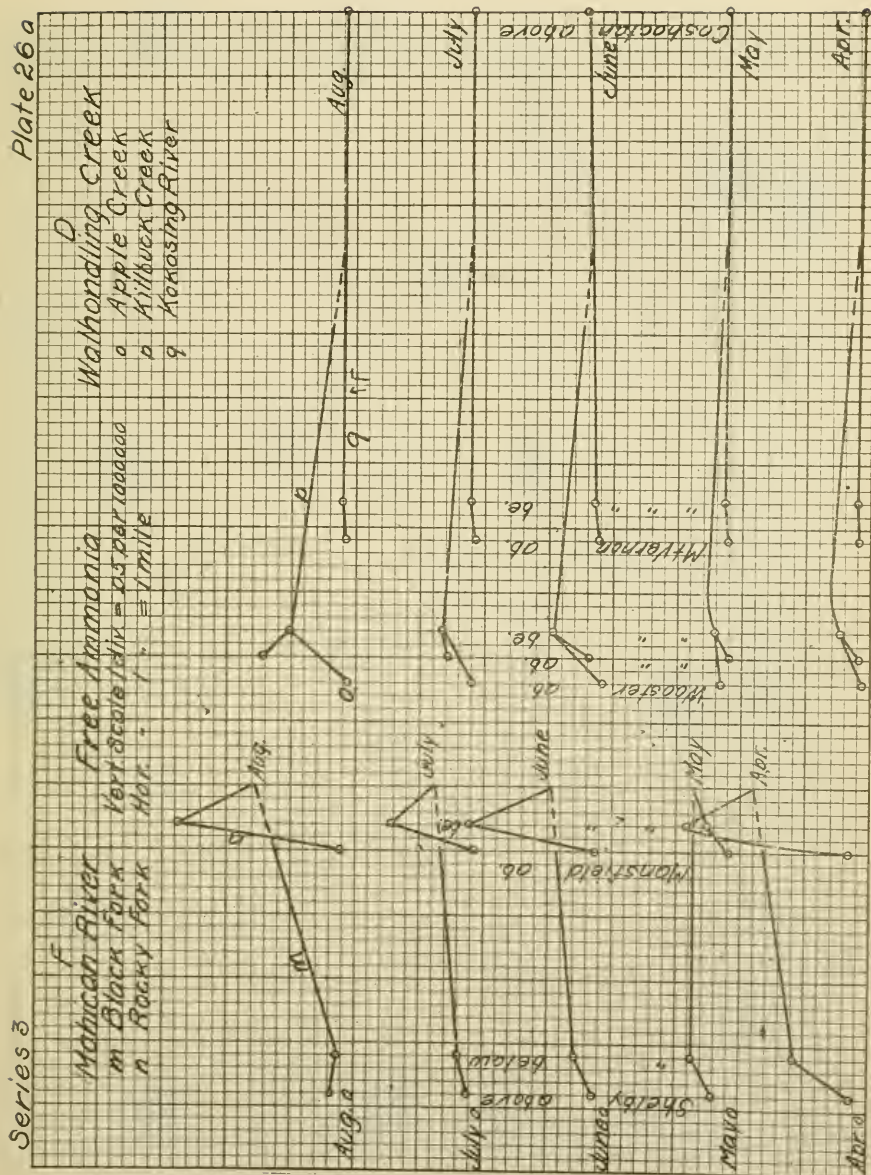


Plate 28

Series 3

F

Mohican River

m Black Fork

n Rocky Fork

Nitrates

Vert. Scale 1 in. = 1 per 100,000

Hor. " 1" = 1 mile

D

Walwhanging Creek

o Apple Creek

p Killbuck Creek

q Kokosing River

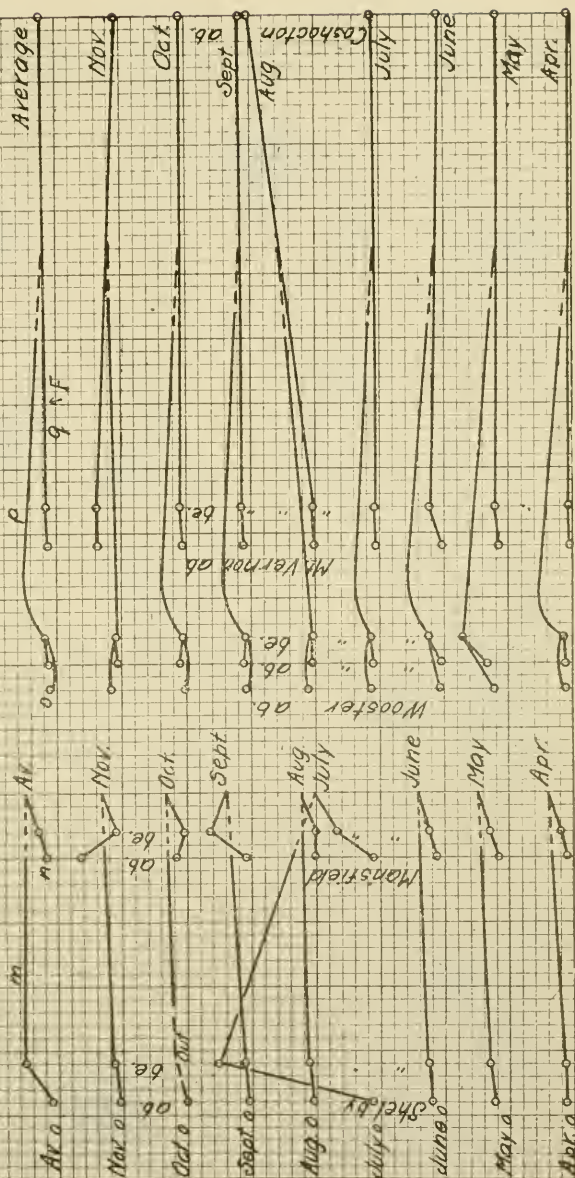


Plate 30a

Series 3

五

Mohican River

m Black Fork

n Rocky Fork

Alkalinity

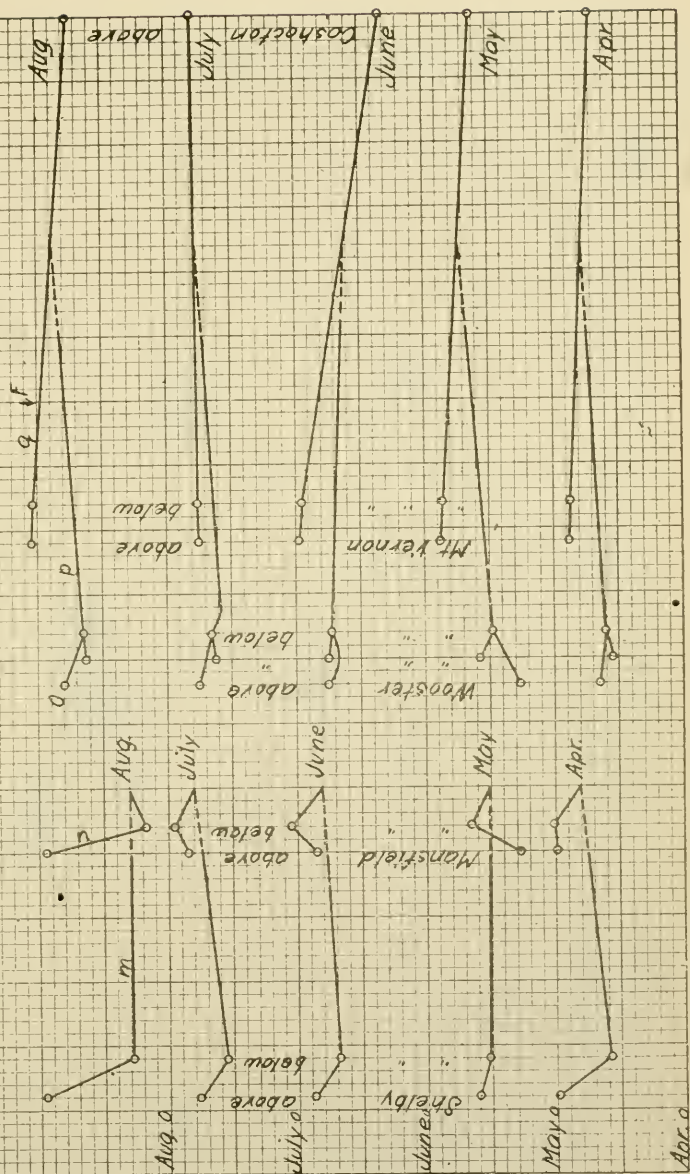
$$\text{Vert. Scale/div} = 20' \text{ per } 1000000$$
Har. 1. ~~1~~ / mile

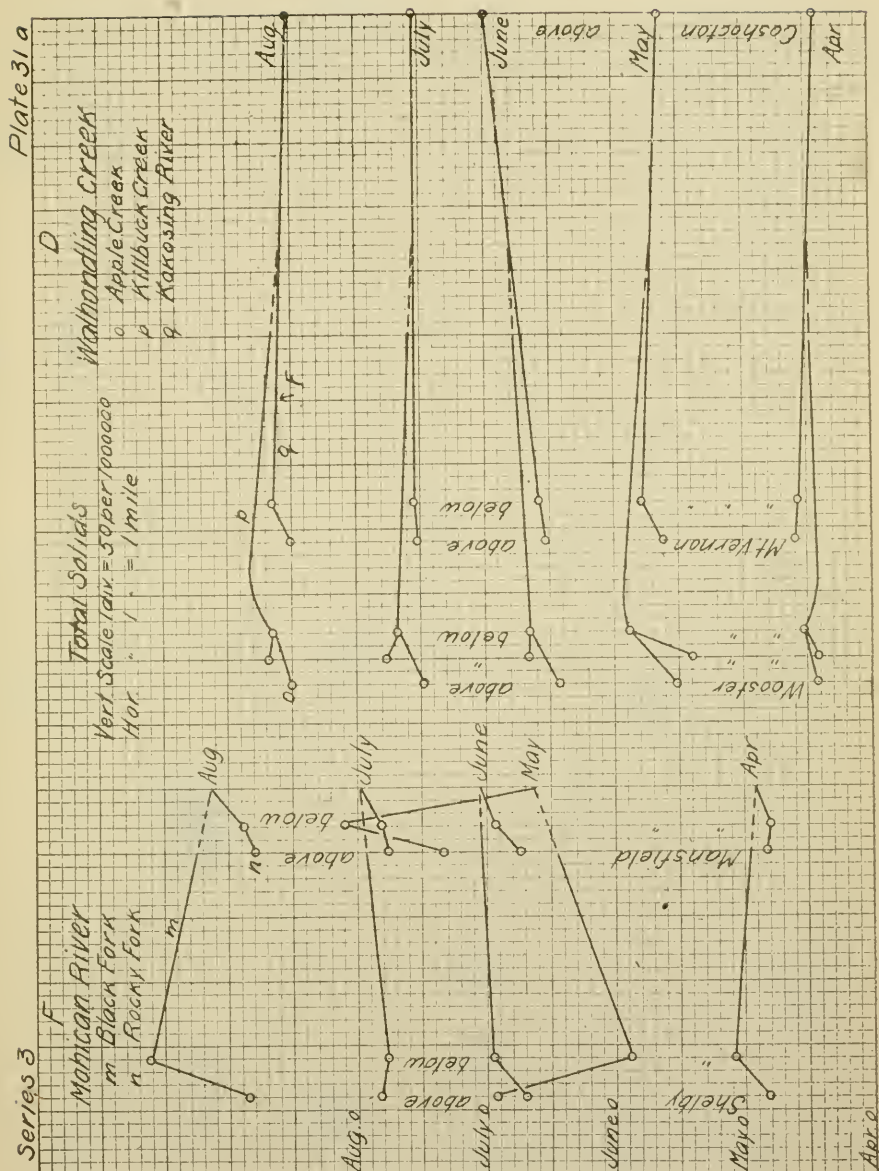
Waltonding Creek

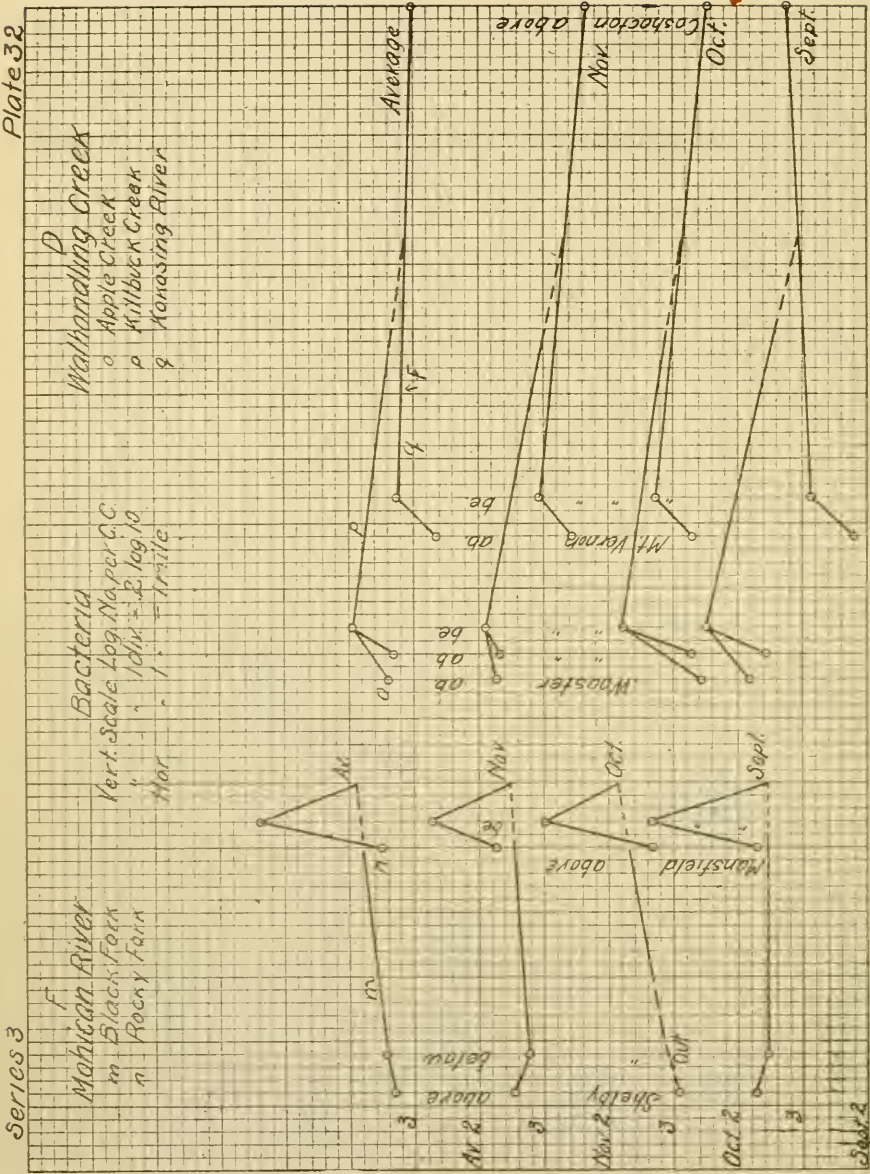
o Apple Creek

to Killbuck Creek

13114 busoskov 6 kokosing river

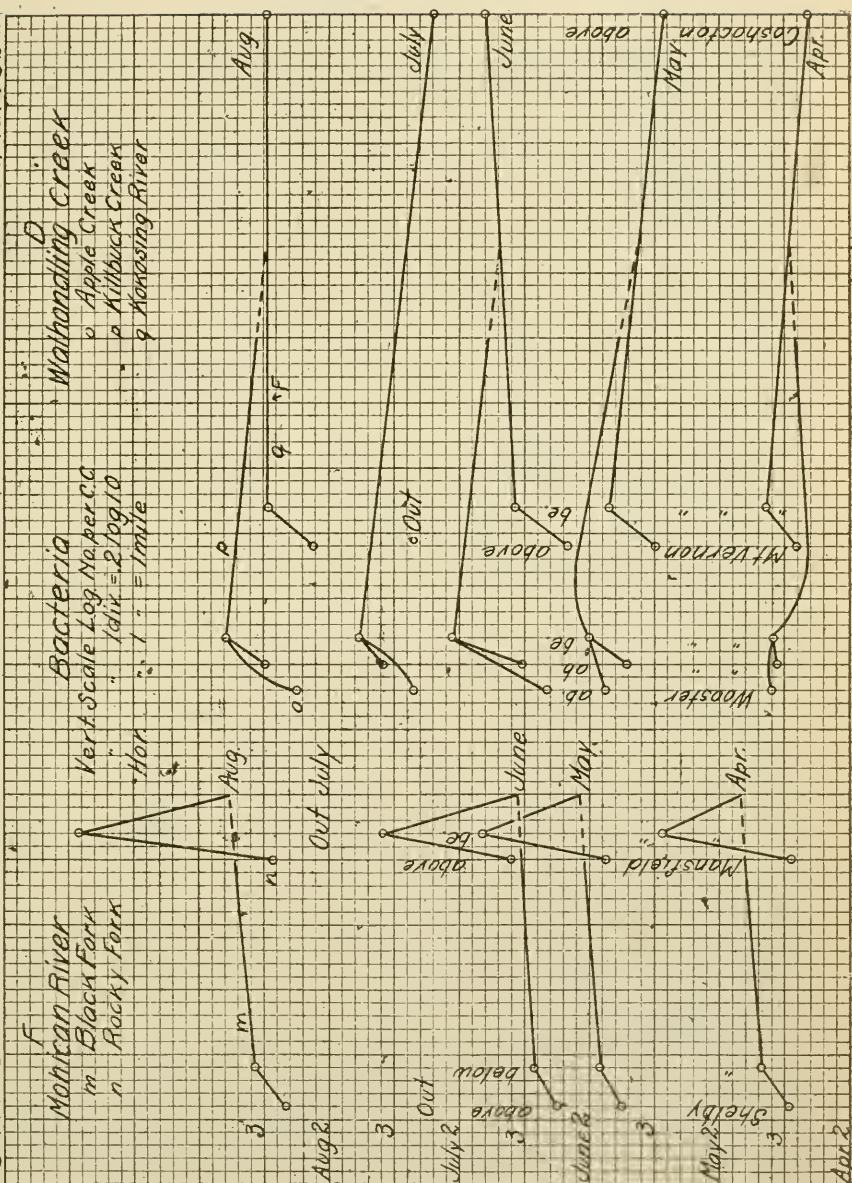






Series 3

Plate 32a.



DISCUSSION OF TABLES AND PLATES.

The discussion of the analytical results expressed in the foregoing tables and plates is much simplified by taking up first the tributaries and finally the main stream in the following order:

- B. Licking Creek.
- C. Wills Creek.
- E. Big Stillwater Creek.
- D. Wallhonding System including F, Mohican River.
- A. Tuscarawas and Muskingum Rivers including Nimishillen Creek.

The letters refer to the corresponding set of curves.

B. LICKING CREEK.

There were four sampling places on this stream located as follows: above Newark near the waterworks, below Newark, at Zanesville above local pollution, and lastly in Zanesville at the ice field. No April sample was taken at the third named station.

Physical Properties. The physical characters of this stream, as revealed by the results for color, turbidity, sediment, and odor, must be considered as fairly satisfactory for an open stream under usual conditions, but are not so on the addition of Newark sewage nor after heavy rains. In the latter case the water carries some clay and other suspended material, especially in its lower course. The June samples show the effect of the very heavy rain on the 20th of the month, which amounted to 5.58 inches at Pataskala. The July collections show a similar effect but lessened in degree.

Organic Matter. Oxygen required. (Plates 12 and 12a). The high findings for June and July show the presence of large amounts of vegetative matter borne by the high water at the times those samples were collected, and the rise in the curve each month below Newark is consistent with the known addition of the sewage of that city. The slight increase in the oxygen requirement from above Zanesville to the ice field station is more noticeable if we omit the June and July findings which are not normal ones owing to the high water. The curves show that in the onward course of the stream the amount of carbonaceous matter increases. The falling off from Newark to Zanesville in the June curve arises from the fact that the Zanesville samples were taken on the 21st of the month and some forty hours earlier than the Newark collections, so that the effect of the heavy rain of the 20th and 21st was felt more severely in the samples from the latter place.

Nitrogen as Albuminoid Ammonia. (Plates 13 and 13a). The albuminoid ammonia in Licking Creek rises with the addition of Newark sewage but falls again only in September. That it does keep up, like the oxygen requirement, is due not to so much to failure of purification or to

the addition of sewage at other points as to the increase of vegetative material in the water. (Compare with the free ammonia curves of plates 14 and 14a). The June and July findings are high from the causes mentioned in the preceding paragraph, but the course of the June curve above Zanesville seems not to have been entirely due to vegetative factors in view of the free ammonia and the chlorine findings at that time. A study of the curves other than for June, shows in general an increase in the albuminoid ammonia between the two stations at Zanesville.

Nitrogen as Free Ammonia. (Plates 14 and 14a). The direction of the June curve above Zanesville was just referred to, while the remaining curves show the expected rise due to the sewage at Newark, and a slight rise at the ice field station in consequence of the sewage from the Muskingum County Infirmary.

Nitrogen as Nitrites and Nitrates. (Plates 15 and 16). In view of the small amount of previous sewage contamination as indicated by the low chlorine, we would expect to find only small amounts of nitrogen in the form of nitrites or nitrates, and such is the case, except for the perceptible increase directly below Newark where the pollution is most concentrated.

Mineral Characters, Chlorine. (Plate 17). The usual upward bend of the curve due to the salt of sewage is seen below Newark, and the relatively higher amounts of chlorine obtained there in dry weather is consistent with a decreased volume of water in the creek while the volume of sewage is nearly constant. Between Newark and Zanesville the map shows Licking Creek receiving some half dozen tributaries, but as the Licking basin is very narrow in that region these streams amount to very little and the dilution is not what might appear at first glance. Since the chlorine determinations vary but little below Newark, it shows that enough chlorine is brought in by the tributary waters to equal their dilution. The rise of the June curve above Zanesville sustains the inference of sewage influence expressed in the ammonia discussion, and it would seem it had been brought in by the high water.

The addition of the sewage from the Muskingum County Infirmary, while not great in amount, should, however, cause an increase of chlorine between the Zanesville sampling points, as in the case of the oxygen required and the ammonias. That such an increase in the chlorine does not appear may possibly be explained by the statement of an old resident of the section, who told the writer at the time of one of the ice field collections, that for a mile or a mile and a half up the creek there were various springs. This information has not been confirmed, but the addition of spring water containing little or no chlorine would offset the chlorine influence of the infirmary.

Alkalinity. (Plates 19 and 19a). The curve of average shows the water of the stream has a tendency to decrease in alkalinity in its lower course. In the later months, i. e. during the low flows, the alka-

linity above Newark was less than below town, and is the result of the variation in relative volumes of water and sewage with possibly some influence from the tributaries entering at Newark. The marked drop below Newark in June came no doubt from the excessively heavy local rain (See rainfall table, Pataskala) which fell on the area drained by South Fork, while the observing stations on North Fork, where the upper sampling point is located, record a precipitation of less than an inch.

Incrusting Constituents. (Plate 18). The scale forming elements in the water of Licking Creek are quite low and fairly uniform throughout the course. The results indicate that the water of Raccoon Creek and South Fork plus the sewage of Newark is slightly lower in chlorine and sulphates of calcium and magnesium than the water of North Fork.

Since the low chlorine of Licking Creek is not in excess, considering the population of the drainage area, and since the chlorine and incrusting constituent curves have little in common, it can be inferred that the chlorine is largely in the form of common salt and that the incrusting constituents are mainly sulphates. The falling off in the April and August curves at Newark is the result of the higher findings above town.

Total Solids. (Plates 20 and 20a). The curves for solids follow in general the alkalinity except for a marked departure in June due to the presence of so much soil in the roilly water. The June sample above Zanesville is higher in total solids than the one at the ice-field. The former station was located near a natural water-fall which would cause the water to be well stirred up, while the lower station represents the quiet water held back by the dam of Hook, Aston & Co., and therefore subjected to some sedimentation.

Dissolved Oxygen. (Plate 22). The curves show a drop at Newark due to the addition of sewage, and another decline between the Zanesville sampling points. The latter variation would seem to result from the waterfall above the upper Zanesville station rather than from the small pollution introduced between the two stations.

Bacteria. (Plates 21 and 21a). The effect produced on the water by the introduction of Newark sewage is nowhere better indicated than in the curves of these plates. The June samples represent a very high stage of this stream due to the heavy rain influence of that period, and in that month we find the flattest curve. The station of great pollution is the one but little changed in its number of bacteria by the addition of much surface washing, and we find this to be the case here. The number of bacteria below Newark in June varies proportionately less from the average than do the other three stations where the increase in numbers over the average is very marked. Omitting the June determinations as representative only of flood height periods, appearing but seldom and then for a short time only, we find the following averages: above Newark 510, below Newark 4500, above Zanesville 600, Zanesville ice-field 660. The water tends to bacterial purification after the addition of Newark

sewage, but does not regain the standard shown above the point where that sewage is received. In addition to the June samples, the Newark samples for July were considerably influenced by rainfall, while a light rain fell the night before the November collections were made at the city mentioned. By reference to the analytical table it is seen that the bacterial findings above Newark were considerably higher in those months. Taking the results of the remaining five months as those uninfluenced by the immediate effect of surface washings following rains, we have an average of 240 bacteria per cc. as representing the conditions above Newark in fair weather periods—which is not bad for an open stream.

SUMMARY OF LICKING CREEK.

The results of the analyses indicate that the water of this stream above Newark for much of the time shows only traces of any effect of the rural population residing on its drainage area. The stream ordinarily carries but little vegetative material above Newark, but where rainfalls have occurred when the surface washings from the cultivated areas bring objectional matter into the creek so that the water is to be considered undesirable for domestic purposes.

Considerable purification takes place between Newark and Zanesville, but the results show that after the addition of the sewage of Newark the water does not regain the degree of purity previously possessed. The analyses show that from Newark to Zanesville the banks of the streams of the tributary waters supply slightly more vegetative organic matter than is cared for by the natural process of purification. The results, especially for oxygen requirement, bacteria, and the ammonias, indicate some pollution is occurring between the Zanesville stations. Part of this is obviously from the Muskingum County Infirmary while part may come from the buildings located on the banks of the creek nearer the ice-fields. However, the investigation shows that the water at the Zanesville ice-field is not suitable for domestic purposes; and the free use of ice cut from that locality can not be considered a sanitary procedure.

C. WILLS CREEK.

There were but two stations on this stream, viz., above and below Cambridge. The upper station was located opposite the intake crib of the water works just above the mouth of Leatherwood creek which tributary bears the refuse of the tin-plate mill and some washings from the Guernsey County Children's Home. After the April collections the upper station was shifted to a point some rods farther up stream in order to avoid any influence from Leatherwood creek as the opportunity was good for back water at that place.

Physical properties. These were bad. In five out of the eight samples from above Cambridge there was considerable sediment, while the clearest water obtained above town was on Aug. 29,

after a period of twenty-five days without rainfall and then the turbidity was .21, i. e., the platinum wire could not be seen when more than five inches beneath the surface of the water. At one of the midsummer collections the liveryman was asked if the water of Wills creek ever became clear and gave this reply, "I have lived here eleven years and I remember just once when the water was clear enough to see the bottom," and the stream is shallow enough. The average turbidities were .71 above town and .52 below, the increased clearness below town being the result of some precipitation of the suspended clay by the waste products of the manufactories located at Cambridge. The sulphate of iron from the rolling mill would serve especially well for this purpose. The odors above town were bad enough but they were not improved in the samples below town.

Organic Matter. Oxygen Required. (Plates 12 and 12a.) As a rule the curves exhibit a decided drop between the stations, due doubtless to the precipitating action of the factory effluents mentioned above. However the carbonaceous matter in the water above town is high enough so that a liberal decrease may occur and yet leave considerable, as is shown by the average of 4.94 parts per million found at the lower station, a decrease of 22 per cent from that found above town. Decaying vegetation seems to be constantly found in the soil of the river-bed, and naturally with the stirring up of this in high water together with the addition of the usual organic material found in surface washings the results were not low under rain influences.

Nitrogen as Albuminoid Ammonia. (Plates 13 and 13a.) As a rule these curves agree in direction with the preceding ones for oxygen required, showing lower results below than above town, which is unusual and is attributable to the precipitation process. The decrease for albuminoid ammonia is not as great as for the oxygen requirement since the sewage of the city came nearer to contributing an amount of the former equivalent to that carried down by the coagulating and precipitating action of the factory wastes than was the case with the oxygen required. For some cause, not apparent, the determination above Cambridge for October is low—and is lower than the other findings for organic material would suggest, and thus causes a marked turn of the October curve. With this exception just noted all the albuminoid ammonia findings are high and indicate much undecomposed organic matter in the water.

Nitrogen as Free Ammonia. (Plates 14 and 14a.) Attention is called to the amounts of nitrogen in the form of free ammonia found above Cambridge. These are high for a water receiving no direct sewage, and would seem to be due to the combined influence of much organic matter in the water and a condition in the stream very unfavorable to oxidation. At times the surface washings bring into the stream the

refuse from isolated privies, etc., and the purification is of course very tardy. While the free ammonia above the city is high throughout the season except in November, yet the influence of Cambridge sewage is seen in the decided upward tend of these curves. The increase in free ammonia below the city is most in evidence during the low waters of July, August, September, October and November.

Nitrogen as Nitrites and Nitrates. (Plates 15 and 16.) The nitrites and nitrates were both unusually high in July, and the cause must have been somewhere up stream as the influence is seen in the above town samples as well as below. A similar but less marked occurrence appeared in May. The agency causing these variations is not known at this writing.

Mineral Characters. Chlorine. (Plate 17.) The average of the chlorine determinations above town is misleading owing to the exceedingly high finding for April. Aside from the average and from April, the remaining curves show a decided increase in chlorine between the two stations. According to the data in the engineer's report there would not be enough household sewage admitted at Cambridge to account for the increase in chlorine. Part of the added chlorine is due to household sewage and part to the factory sewage of the city. While the chlorine and the free ammonia agree in pointing out the fact that sewage is added yet the curves for these substances do not maintain the similarity month by month that is usually observed, since the chlorine derived from the mill wastes is not constant in amount owing to its intermittent discharge into streams. The factory wastes therefore modify the chlorine curves to a much greater degree than they do the free ammonia curves. As far as can be learned no gagings have ever been made of Wills creek above Cambridge, but roughly estimating the volume of water by the relative extent of drainage area as compared with streams that have been gaged, the rural population on the watershed above Cambridge would not yield near enough chlorine to account for what was actually found in the water. (The data for such an estimation is to be found in *Examination of Sources of Public Water Supplies of Ohio*, 1898, pp. 39, 113, 115.) The water above Cambridge shows the presence of chlorine from ground sources—and part probably comes by way of the mines situated up stream.

In considering the high figure for April it is to be remembered that the determinations for organic matter and the absence of sewers at any place above Cambridge show that, beyond a doubt, this chlorine had nothing to do with household sewage. This April chlorine pollution is unique as it stands out by itself being many times greater than any like determination at either station during the season. One explanation is that the tin plate mill may have let out a considerable amount of waste at the time, and, in the low condition of the stream which was very low for the season of the year, the water from Leatherwood reached the sampling point which that month was near the mouth of Leatherwood

creek and just opposite the intake crib. In support of this explanation we find a higher incrusting constituent than again appeared at this station, but opposed to this the alkalinity is not down as would naturally be expected if much muriatic acid were contained in the waste from the mill.

A second theory which seems on the whole to have more weight is that the major part of the chlorine came from upstream and probably from wells bored for oil.

On portions of the Maumee system in the work of 1898 we found much salt water thrown out by oil wells, and the writer was recently informed that in the spring of 1899 some wells were put down in the valley of Wills creek some distance above Cambridge. If this chlorine was derived from some up-stream locality, there would be such a mixing in the passage down stream as to insure a fairly constant chlorine character in a considerable stretch of water, and thus the finding of 163.4 parts of chlorine per million would be approximately correct for a large amount of water. The volume of water added between the stations is not capable of producing a dilution such as to reduce the chlorine finding below town to 5.6 parts—the amount found in April. Then, if the chlorine polluting source was up stream some distance, the samples must have been taken at that opportune time when the advancing front of the pollution had passed the above town station but had not reached the lower sampling point. The work of the later months showed no like occurrence.

The curves for *alkalinity* (Plates 19 and 19a) and those for *incrusting constituents* (Plate 18) show the addition to the creek of acid substances between the sampling points, although the reaction of the water in no case was acid. The addition of acids caused a decrease in alkalinity and an increase in the scale forming elements. The average decrease in alkalinity between the two stations was 44.3 parts, and the increase in incrusting material was 24.9 parts. Of course it is not claimed that the change was entirely due to the products from the manufactories, but they are doubtless responsible for the major part of it. The decreased hardness generally observed in river water when the streams are swollen from heavy rains is apparent here in June when the total hardness as shown by the combined alkalinity and incrusting constituents was lower than again occurred at either of the stations.

The greatest amount of scale forming matter above town was obtained in April when the collection was made nearest the mouth of Leatherwood. After the September collection, a dam was thrown across Leatherwood creek a few yards above its mouth and I am informed that the tin plate mill had partially shut down in October, so that a decreased acid influence might be expected in the two later months of our work. Referring to the tables it is seen that above town the alkalinity rose for October and November, while the incrusting constituents were lower than they were in the other two dry months, viz., August and September with the flow at approximately the same stage. Below town the increase

in alkalinity and decrease in incrusting constituents was even more marked in the two last months of our work, showing plainly the falling off in the factory contributions to the stream.

Total Solids. (Plates 20 and 20a.) The presence of the high amount of chlorine in April is verified in the curve for solids; the greatest amount of suspended clay is seen in the June curve; the effect of the impromptu chemical precipitation plant is seen in the falling off of the total solids between the upper and lower station and especially so in the earlier months, when there was more clay present. The curves for solids follow no one factor but allowing for the clay and chlorine irregularities these curves follow very well the combined alkalinity and incrusting constituent factors.

Dissolved Oxygen. (Plate 22.) With the exception of a slight increase between stations in October and a more marked one in July there was a general decrease from above to below town. The determinations are of greater interest because of their low averages. The average amount of dissolved oxygen was lower below than above Cambridge while there were but two other stations on the Muskingum watershed yielding lower averages for free oxygen than above Cambridge, and they were below Mansfield and below Massillon where strong pollution was felt. This generally low dissolved oxygen is consistent with the quiet, sluggish flow of Wills creek, and the large amount of organic matter carried, and accounts for the lack of activity in oxidation.

Bacteria. (Plates 21 and 21a.) In June we have the usual increased findings accompanying high water stages of a stream. The results below town show a greater number of bacteria than was obtained in the upper sample for the same month—except in the cases of September and November. In both of these months the findings above town were much above the other findings at that station (excepting high water in June). In September we find from the rainfall table that a rainfall of .71 occurred the day previous to the collections, which would naturally increase the bacterial contents of the water. From the other factors in the September analyses it is seen that the water below town was less influenced by this rain than above, or else that the factory effluents had relieved the water of considerable suspended material. The rainfall table also records a light rain just previous to the November collection, but compared with similar conditions at the same station it is not alone responsible for the November result above town. While there was in general an increase from the above town station to the below town one in the number of bacteria, yet it is not as great an increase as would be ordinarily expected. The failure for a greater rise in the curves is apparently due to the low number of bacteria below town. Omitting June for reasons given above, and October and November for reasons given hereafter, the average number of bacteria in the water below

Cambridge in five tests was less than 1,200, and that water contains sewage matter.

It is doubtful if there was enough concentration of acid at any time to interfere seriously with the life functions of the bacteria, but there must unquestionably have been many bacteria carried down with the coagulated suspended matter in the accidental chemical precipitation occurring in the stream. In October and November there seems from the chemical analyses to have been a cessation in the amount of waste products from the manufactories and we find the number of bacteria below town in those months much higher than at any other time aside from the count for June.

SUMMARY OF WILLS CREEK.

The investigation shows that the water of Wills creek carries at its best considerable quantities of clay and organic matter, and during much of the year these quantities are increased to such an extent as to make the water repulsive. The sluggish flow (engineer's report), unbroken in the main by ripples, falls, or dams, is not conducive to oxidation and the consequent purification by natural agencies is slow and incomplete. As a result of these conditions we find the pollution of the stream by surface washings from the area drained yielding an amount of organic matter in excess of what can be duly oxidised.

The city of Cambridge introduces into the water of this stream in addition to the storm washings and household sewage the waste products of certain manufacturing establishments. Household sewage is not helpful to the purity of the stream and under conditions so adverse to oxidation any large amount of it would be seriously objectionable. On the other hand, while the wastes from factories are as a rule obnoxious pollutions and exert some detrimental influence on the waters of flowing streams, and while the mill wastes at Cambridge are not exceptions to the rule, yet it is to be noted that the water below Cambridge gave evidence along certain lines of some beneficial action from the mill contributions. There was a varying amount of chemical precipitation taking place at Cambridge in the water of Wills creek, but as it was accidental, unregulated, and uncared for it could not be expected to be productive of any extensive and continued benefit.

Of course the chemicals added to the stream at Cambridge gave rise to a larger proportion of scale-forming material in the stream, but in contemplating the water for steam purposes it is to be remembered that the removal of suspended matter would in part equalize the matter. As shown by the August and September findings there was in low stages acid material enough at times to make the water too hard for boiler purposes.

On the whole the water of this stream does not show the sewage pollution of several of our Ohio streams, yet of those which have been

investigated this one is easily entitled to first place on the ground of repulsiveness of appearance. Owing to the large amounts of suspended material and unpurified organic matter, this water is not entitled to consideration for a public supply in the raw state. The proximity of the intake crib of the waterworks to the mouth of Leatherwood creek rendered the city water liable to some extent to the pollution of that tributary. It should be added that the old supply was used only for fire and sprinkling purposes. Fortunately, at the time of writing, the city of Cambridge has secured from ground sources a new supply which bids fair to furnish a satisfactory water not only for sprinkling and fire purposes but as a beverage for man and beast.

E. BIG STILLWATER CREEK.

Two stations were established on this stream; the upper one was located at the intake of the Dennison Water Supply Company where the water is obtained for the joint supply of the villages of Uhrichsville and Dennison; the lower one was situated a short distance below the mouth of Little Stillwater creek, which tributary receives most of the sewage of Uhrichsville and all of that from Dennison.

Physical Properties. In all of the samples taken at these two stations there was a pronounced sediment with the exception of the above town sample in October which showed a very slight deposit. Only in the collections of the three later months did the turbidity reach a respectable reading, for, aside from the fall samples when the water was quite free from any rainfall of great extent, the clearest water obtained above town would hide from view the wire of the turbidity stick when submerged beyond a depth of about four and one-half inches, and the average turbidity of our samples was such that the wire could be seen only two inches below the surface. It may be wrongly assumed that the samples chanced to be taken at particularly roilly periods, but a study of the rainfall table for the adjacent observing stations, Canal Dover, Carrollton, and Cambridge, shows that such was not the case, and that on the contrary only light rains (less than one-half inch) fell at any time for some days previous to the sampling dates save the collections of May 31st and July 20th.

The odors were undesirable as might be expected from the amount of vegetative matter present in the water, and but twice was the water free from odor above town.

Organic Matter. In comparing the results of the examinations below town with those above, it should be borne in mind that there is added between the stations something besides the sewage of the two villages, viz., the water of Little Stillwater creek. As samples were not taken from the stream just named we can determine the nature of its water before receiving the pollutions of these villages by indirect methods only. From the sewerage tables in the accompanying report of the engineer

we find the sewer population of Little Stillwater above Uhrichsville and Dennison is to the sewer population of Big Stillwater above those villages approximately as three and one-half to one, while the drainage areas are about as one to five. Bearing this in mind a study of the chlorine and free ammonia findings as indicative of sewage influences, and of the oxygen requirement and the albuminoid ammonia as indicative partly of animal and partly vegetative organic matter, it would seem to be true that while Little Stillwater creek above the two villages contains a higher proportion of sewage pollution than Big Stillwater the latter is richer in vegetative matter. The absence of gagings makes the solution one of approximation.

Oxygen Required, (Plates 12 and 12a) and *Albuminoid Ammonia*. (Plates 13 and 13a). Owing to the large amounts of vegetation found in this water these factors are closely related and the two sets of curves are quite similar. As would be expected from the addition of sewage the results below town are higher than those above with exceptions of July and August. The latter departure will be discussed under the next section with the free ammonia, but that for July seems attributable to a variation in rain influences on the two streams. In order of greatest rain disturbance the July collections are next to the samples taken May 31st. By consulting the rainfall reports from the observing stations around the basin of the Stillwaters it is seen that the precipitation at Cambridge was nearly double that at Carrollton, i. e., the southern portion of the basin received in the few days previous to the July sampling nearly twice the rainfall that the northern portion did. As a consequence Big Stillwater, draining the southern portion, contained a proportionately larger amount of vegetative matter than did Little Stillwater on the north, since the influx of sudden surface washings causes a marked increase in the amount of vegetative material in an open stream. Therefore in July the oxygen requirement and albuminoid ammonia above town in Big Stillwater exceeded that normally in Little Stillwater plus the increase due to the sewage of the two villages, and thus the July curve shows a drop between the two stations. The turbidities as indicative of rain influences sustain the preceding statement.

It is claimed that there is an unusually large amount of debris in the clay and silt deposited in the beds of the two streams, and this is no doubt true, for the May findings are high and at that time the deposits were stirred up by the high waters; still much of the May result is due, of course, to surface washings.

Nitrogen as Free Ammonia. (Plates 14 and 14a). The addition of the sewage from the twin villages is well shown in the determinations for free ammonia. In times of low water, as represented by the later samples, the curves show marked inflections, and so decided is the sewage influence that it is quite noticeable even in times of higher water. The August curve shows a decrease between the stations, but this was not

without cause, for we found the amount of nitrogen as free ammonia occurring at the upper station was nearly 50 per cent. higher than in any other month, and in addition, the oxygen required and the albuminoid ammonia were also greater at that time for the station named, while the nitrites from the two stations were equal. It is apparent that the water above town in August contained from some source a pollution nitrogenous in nature. That this was not a sewage pollution would appear from the findings for chlorine, bacteria, dissolved oxygen, as well as from the fact that the slight sewage pollution of Piedmont would hardly be able to produce such an effect except under very unusual conditions, and no other source of like pollution was disclosed on the upper course of Big Stillwater. It might be mentioned that no rain had fallen for two weeks previous to the August collection.

Nitrogen as Nitrites and Nitrates. (Plates 15 and 16.) The conditions in this stream are somewhat like those in Wills creek as regards oxidation, and as a result we find the nitrogenous matter but little oxidized. The nitrites varied but slightly and the nitrates less. The former were always present above town and their failure to increase below town may possibly be taken as showing in part slowness of purification, and in part as indicative of a lower amount of nitrites in the water of Little Stillwater as it comes down to Uhrichsville and Dennison.

In May alone do we find a marked increase in nitrates below town, and that this is not due to the general high water, bearing decayed material washed in from the banks, is shown by the findings above town for that month which was not out of the ordinary. The May result then seems to be due to influences on or in Little Stillwater.

Mineral Characters. Chlorine (Plate 17.) With the exception of August, when the free ammonia curve is valueless as a sewage indicator by virtue of the special pollution above town, which was mentioned under the free ammonia discussion, the curves for chlorine and nitrogen as free ammonia agree well in giving evidence of the presence of Dennison and Uhrichsville sewage. The August curve for chlorine is undisturbed by the special pollution, and remains a good indicator. Flattened curves under the influence of surface washings are seen in May and July, when the stream was high, while the low stages of the creek, through the relatively larger proportions of sewage, give rise to more abrupt departures in the chlorine curves. (See curves of later months.) It is to be regretted that gagings could not have been made on this stream, for with the actual volume of water known, the amount of salt from mineral sources could have been closely determined. From the Engineer's report on the Muskingum watershed it will be seen that a few mines, oil wells, and an occasional creamery occur in the Stillwater basin, and therefore some chlorine of a mineral nature is likely present. Additional evidence of this appears in the May curve when the high water by its excess of volume in comparison with sewage modification gave a flat curve—yet the actual

amounts of chlorine found in that month were far too high for the population of the basin. For this reason it is to be borne in mind that the value of the chlorine findings as a sewage indicator rests in the course of the curve rather than in the actual amounts of chlorine found.

Alkalinity. (Plates 19 and 19a.) *Incrusting Constituents.* (Plate 18.) With two exceptions each the alkalinities are lower and the incrusting constituents higher below than above town, which means that the contents of Little Stillwater as introduced into the larger stream possesses a higher incrusting power and a lower alkalinity than the water of Big Stillwater above that place. To what extent this condition should be attributed to the natural water of the smaller stream or to the sewage it receives cannot be stated from the data at hand, but in view of the existence of the small steel plant at Dennison it is fair to presume that some acid is in the sewage, and would help toward the end mentioned.

The alkalinity of Little Stillwater was evidently unusually high in October, as then the carbonates at the lower station were at their highest, and higher than were found at the water works intake on the same date. The course of the incrusting constituent curves was unusual in May and August, and was due to the low finding below town in May, accompanied by the highest finding of the season above town, while in August the same result occurred, but was less marked.

Taking the combined alkalinity and incrusting constituents as representing the soap consuming power of the water, we have in Big Stillwater creek a softer water than that of any of the streams, except the Mahoning river, which have thus far been included in this series of investigations by the State Board of Health. At the time of writing mechanical filters have been erected for use by the water company supplying the villages of Uhrichsville and Dennison. In these mechanical filters sulphate of alumina is used as a coagulant. Now, the amount of alum which can be decomposed in the process depends on the alkalinity of the raw water. In this case the lowest alkalinity obtained at the intake is amply able to decompose more alum than should be used, and thus there is no cause for the consumers to worry for fear there is any undecomposed alum in the filtered water now to be furnished them.

Total Solids. (Plates 20 and 20a.) The figures for total solids here, as in other muddy streams, do not agree closely with the alkalinity and the incrusting material (and at times the chlorine) except when the water is fairly clear, but if we add to that list the suspended matter as indicated by the turbidities, then the results appear more satisfactory. In this stream the relation of the sudden departures in the total solid curves to the suspended clay is very apparent, being shown in the extreme by the muddy samples of May. The increase of chlorides and incrusting constituents between the two stations more than equalizes the decrease in turbidity and alkalinity, hence there is an increase in the average amount of solids at the lower sampling place.

Dissolved Oxygen. (Plate 22.) In the curve of averages as in most of the months there is shown a decrease in the amount of dissolved oxygen between the stations. Both stations give high results for August, while the September figure was high at the lower station, but not at the upper one. On the whole the amount of free oxygen is low, showing that purification processes should be tardy of action in this stream owing to the quiet, sluggish flow and the presence of considerable organic matter in the water.

Bacteria. (Plates 21 and 21a.) The figures and the curves for bacteria show that increase in the conditions favorable to microbic propagation which ordinarily results on the addition of sewage to a flowing stream, and they call for no special comment except in one or two particulars. In connection with the nitrogenous pollution above town in August, it is to be noted that we found the lowest number of bacteria obtained at the station near the waterworks. In September the direction of the curve between the stations is downward, a very unusual occurrence where any sewage is added. The finding at that time below town is an unusually low one, and is not in accord with the chemical results obtained from that sample. In view of the other data it would seem that the bacterial finding below town in September was misleading, and it should not be given full weight.

SUMMARY FOR BIG STILLWATER CREEK.

With an average turbidity of .50 obtained in eight tests, and with averages of 7.46 parts oxygen required, nitrogen as nitrites .007 parts, nitrogen as free ammonia .089 parts, and nitrogen as albuminoid ammonia .257 parts, and since the work on other rivers has shown that these averages could not be expected on the whole to materially improve in the four untested months (December to March), it is quite evident that the water of Big Stillwater creek is not only unsightly much of the time, but is also objectionable *in the raw state* for a public supply owing to the large amount of organic material it carries. That a people would continue to use such a water for a number of years is another illustration of the forbearance of the consumers or else their utter indifference as to the quality of the water they drink or use. Such a water as is found in Big Stillwater is not to be satisfactorily handled by sand filtration, as the amount of clay and silt leads to difficulties. The attempt, by the water company supplying the villages of Dennison and Uhrichsville, to use sand filters was not a success. Such a result could have been foretold from these studies had the question of treating the water arisen subsequently to this series of river investigations to determine the character of Ohio waters. While the water must be considered in an untreated condition as objectionable, yet it is of such a nature as to yield on treatment by mechanical filtration, a very satisfactory and potable water, and as the public supply of Uhrichsville and Dennison at this writing passes.

through mechanical filters, the citizens of those villages should receive a good water.

As the conditions for oxidation in this stream are unfavorable, it is a stream which would easily become a nuisance on the addition of large proportions of sewage.

D and F. WALHONDING SYSTEM.

NOTE. Owing to the establishment of such a large number of stations on the Muskingum watershed it was a matter of some difficulty to arrange a schedule which would permit the monthly collections to be made in two trips of three days each. As a result it was impossible to include all stations on each basin in the same trip, and therefore some irregularities arose due to the fact that some samples represented one stage of the river while other samples on that stream were taken at a later date and when the river stage had materially changed. From time to time in the discussions which follow reference will be made to this difference in the condition of the stream at times of sampling.

By reference to the diagram on page 521, the relation to one another of the tributaries of Walhonding basin may be seen. Black Fork of Mohican river flows into Rocky Fork, of the same river some twelve miles below Mansfield, then Mohican river unites with Kokosing river some distance below Mt. Vernon, forming Walhonding creek. Apple creek joins Big Killbuck creek at Wooster, and after a long flow of nearly fifty miles Killbuck empties into Walhonding creek some six miles above Coshocton. At Coshocton Walhonding creek and Tuscarawas river unite to form Muskingum river.

Stations were located as follows: Above and below Shelby on Black Fork of Mohican river, above and below Mansfield on Rocky Fork of Mohican river, above and below Mt. Vernon on Kokosing river, above Wooster on Apple creek, above and below Wooster on Big Killbuck creek, the lower station being a short distance below the mouth of Apple creek, and above Coshocton on Walhonding creek. No sample was taken below Shelby in October, as Black Fork was so low there at the time that the water had ceased to flow, and was simply standing in pools.

Physical Properties. In color the waters of this basin do not cover a wide range, since Kokosing river, with an average of .13 and Killbuck above Wooster with an average but a trifle in excess of double that amount stand for the extremes. As regards the amounts of suspended clay and other material expressed by turbidity and sediment, none of the streams of this basin show as high findings as Big Stillwater did. Although the average turbidity of Killbuck creek is less than the average shown on Rocky Fork at Mansfield, yet Killbuck is to be regarded as the muddiest of the Walhonding streams. The Mansfield average is raised by the very exceptional finding for May when the stream was at flood height, while the May collections did not find Killbuck creek suffering so much from extraordinary rains, and in addition is to be noticed that

eleven out of the sixteen turbidities taken at Mansfield are lower than the lowest reading obtained from Killbuck creek at Wooster. In the order of greatest turbidity it seems proper to arrange the streams in the following order, Big Killbuck, Walhonding, Rocky Fork, Black Fork, Apple creek, Kokosing river. Attention is called to the clearness of the water in Kokosing river, for while the figures represent an average turbidity of .125, this figure would be considerably lower if the water of Kokosing had been deep enough at the sampling places to enable a correct reading to be made. From the table it is seen that in ten of the sixteen readings on the Kokosing the reading was made with the turbidity stick resting on the bed of the creek and the wire plainly visible—so that these ten readings were necessarily recorded higher than the character of the water warranted. The only station of this year's work yielding a better average turbidity was above Canton, where in the race at the waterworks the depth of water was practically double what it was in Kokosing river at our sampling places, and in addition an effort is made at Canton to exclude the creek water from the race when the stream is roilly.

In the matter of objectionable odors, mention should be made of the samples from Walhonding creek above Coshocton, Killbuck creek above and below Wooster, Kokosing river below Mt. Vernon, Black Fork below Shelby, and Rocky Fork below Mansfield. For the last named station no word short of foul would express the degree of a stench so intense that after experiencing it during the few minutes required for the accomplishment of the work performed at the bank of the stream the collector invariably felt he was a fit subject for fumigation experiments.

Organic Material. Oxygen Required. (Plates 24 and 24a.) Kokosing river. Taking the oxygen required and the nitrogen determinations as the evidence of organic pollution we find the water of no stream yet examined in this series of investigations equalling that of Kokosing river in freedom from organic pollution. The oxygen required and the albuminoid ammonia determinations are much lower for this stream than elsewhere, and must be considered under the conditions usually prevailing as very satisfactory ones for an open stream. With the exception of May and September the curves for oxygen required show a slight falling off between the two Mt. Vernon stations in spite of the addition of Mt. Vernon sewage. While two very small tributaries enter the Kokosing between the sampling points, they would hardly contribute enough water to dilute the sewage of Mt. Vernon to an extent indicated by the findings, and further, the ammonias do not show such a dilution. A general decrease in the oxygen requirement with a regular increase in the ammonias is to be interpreted as follows: The organic material in the water above town is rather of a carbonaceous nature, but through the influence of additions from tributaries and sewage the organic matter in the water below town possesses more of a nitrogenous nature. The

somewhat higher findings for May and July agree with the albuminoid ammonia and turbidity in showing the presence of surface washings following the rainfall recorded by the adjacent observing stations.

Apple creek is the next lowest in the amount of carbonaceous matter contained, and when uninfluenced by surface washings the results are nearly as good as in the preceding case, but after rains the amount of organic matter rapidly increases. The high results for May and September correspond to the turbidities and the rain influences indicated by the rainfall table.

In all but the first and second samples taken, the oxygen required (and the albuminoid ammonia) of Killbuck creek was higher above town than below. The averages of 6.49 parts above town and 6.89 below show that Killbuck contains a sufficient quantity of organic matter, and the drop which is observed in most of the curves means that during much of the time the amount of carbonaceous material in Killbuck creek is so high above Wooster that the addition of the sewage of the city to Apple creek would not raise the oxygen consuming power of the latter to the level shown in Killbuck above town.

With the conditions existing at Mansfield there is, of course, an upward turn of the curve each month.

In the consideration of these curves for Black Fork of Mohican river as determined by the Shelby samples, several features are to be borne in mind. The surroundings of the stream above the village named are somewhat favorable to the presence in the water of vegetable matter; in Shelby are several manufacturing establishments, as can be seen from the Engineer's report, and the refuse from these factories reaches Black Fork directly or indirectly. For a portion of the distance between the two stations the stream in times of low water is little more than a succession of pools, with the water escaping from one pool into the next by trickling through the gravel rather than by flowing through an open channel. Due to the effects from these factors the oxygen consuming power of the water was frequently lower below Shelby than above. Two exceptions occurred, both being possibly due to rain influences when the creek was low. In both of these months, viz., July and September, the samples were taken after short but hard rains, and in the latter month the above town samples taken as soon as the shower ceased, did not show the surface washing that the lower sample did which was taken an hour later.

The determinations from Walhonding creek above Coshocton show a diminution from the oxygen consuming power found in the northern part of the basin, which result is in part due to processes of purification and in part to the beneficial dilution from the Kokosing water. The curves show two departures which should be mentioned in order to be understood. The June finding at Coshocton is much higher than that of any station above it for that month, because it was taken a week earlier than the remaining samples of the basin, and at a time when the stream

was very high from the excessive rains of June 19th and 20th, while the waters had reached a more normal condition when the balance of the June collections were made. In July the condition was somewhat reversed, as all but one of the nine up-stream samples gave higher oxygen requirements than the Coshocton sample which was taken the week following the other collections. The up-stream July collections showed moderate rain influences which disappeared from the stream by the time the Coshocton collection was made.

Nitrogen as Albuminoid Ammonia. (Plates 25 and 25a.) These curves showed an increase in the amount of undecomposed organic matter as a result of the addition of Mt. Vernon sewage except in August, when the above town result was rather high for low water conditions. The very high finding in May for Apple creek agrees with the other findings of that sample in showing that much organic matter is washed into that stream after rains. The other Wooster determinations (on Killbuck creek) also show surface washings under rain influences. The albuminoid ammonias show the undecomposed nitrogenous organic matter was lower below Wooster than above in spite of the addition of the village sewage, and this result similar to the oxygen requirement, is due to the diluting effect of the Apple creek water.

At Mansfield there was naturally a decided increase below town each month except when both samples were brought to their highest by the surface washings in the flood height of the May collections. The above town finding then was unusually high, but the rest of the analysis indicates it was chiefly a vegetative pollution.

The May samples also show the effect of the very high water in Black Fork, the finding above town being a little the higher. The lowest albuminoid ammonia obtained below town was in November, when it was so low that the upper station exceeded it.

Compared with the remaining points on their curves the high June mark and the low one of July for the Coshocton station are results of the changed stages of the river in the time intervening between the trips as stated previously, in the discussion of the oxygen required. It is to be noticed that the water of Walhonding creek above Coshocton always contained plenty of nitrogen in the form of albuminoid ammonia, having an average of .187 parts per million.

Free Ammonia. (Plates 26 and 26a.) The curves for Kokosing river show but slight increases in the free ammonia between the two stations. This is not to be taken to mean that the sewage pollution of Mt. Vernon is a minor matter, for the accompanying report of the Engineer says the sewage of Mt. Vernon causes at times in low water a nuisance. On the other hand, the character and opportunities of the Kokosing water are favorable to rapid purification, and a glance at the nitrite records show that such was the action; therefore, the free am-

monia results are lower below Mt. Vernon than ordinarily would occur, because the active sewage was quickly oxidized.

The free ammonia findings in Apple creek were also usually quite low, but were higher when surface washings entered.

In the Killbuck results, above and below Wooster, we have a testimonial to the general reliability of free ammonia as an indicator of sewage influences in a stream, for, in view of the large amount of organic matter of a vegetative nature normally carried by this stream as shown in the two preceding sections, and in view of the mineral origin of some of the chlorine to be mentioned later, we have in the finding for nitrogen as free ammonia the clearest analytical evidence of the sewage pollution known to exist at Wooster. The increase of free ammonia at the below town sampling place is very marked each month. In August we find the only instance in which either of the above Wooster findings equals the one below that village. In the month named the free ammonia above Wooster on Killbuck creek reached an extraordinary high figure (.356 parts per million) nearly three times as high as was again obtained at that station, and the oxygen required and albuminoid ammonia were also high there, so that all three of these curves show a drop between the Killbuck stations in August. The figures show a large amount of organic matter in the water of the upper Killbuck for August, but as there had been no rain fall for thirteen days previous to the time of sampling and a precipitation of less than one-half inch in twenty days, the result was not the outcome of general surface washings. The chlorine is such as to permit a sewage cause, but as we cannot exclude mineral sources in that water the chlorine determination is not of assistance. A sewage source for such a pollution is not known to us.

The majority of the November collections were made in dry weather conditions, but the Mansfield samples are exceptions, as that stream had been raised by local rains, and the effect is observed in the flattened free ammonia curve, while the figure for nitrogen in this form was about half the average and much less than any other finding at that station save the flood height sample of May. The amplitude of fluctuation in the ammonia curves for Rocky Fork as well as the other determinations strongly suggests the possibility of the stream having been named from the condition of its contents rather than from any geological consideration. At the station below Mansfield the maximum amount of nitrogen as free ammonia was 1.064 parts per million, obtained in September, while the average was .530, showing a very bad state of affairs from the sewage of the city.

On Black Fork we find at Shelby below town an increase in the free ammonia except in August, when the lower finding was below that again obtained from that station. In connection with the August result just mentioned, it is well to notice that the analysis shows the absence of ni-

trites, and an acid influence not again equalled, while the collector's note book records the fact that the water was so low as not to be flowing.

The figures and curves for the Coshocton station speak well for the distances of the sewage pollutions from the location of this station as the amount of free ammonia here obtained compares favorably with that found in the various headwaters of the Walhonding watershed. The higher findings occurred in the samples showing rain influences and the increased amount would result from surface washings, and possibly a very little, because the higher stage of the river, giving a more rapid flow, would bring the sewage to this station with less time for purification.

Nitrogen as Nitrites and Nitrates. (Plates 27 and 28.) When sewage is introduced into a stream whose flow is broken by ripples and whose water contains but little organic matter and much dissolved oxygen, oxidation is promptly commenced, and a rise in nitrites is found. On the addition of the sewages of Mt. Vernon and Wooster we have such an occurrence in the water of Kokosing river and Apple creek, and it is in evidence in the increased nitrites and to a less degree the nitrates at the station below those villages.

Nitrites were also in evidence below Shelby except in the two months when the water was not flowing. Why the nitrates at the same station were up in July is not clear.

The Mansfield results sustain the evidences of pollution previously obtained, and show an effort toward oxidation, which effort had progressed but little owing to lack of dissolved oxygen.

The Walhonding nitrates above Coshocton in August were higher, and seem to have resulted from the heavy rain in the lower portion of the Walhonding basin (See Warsaw rainfall table) after a period of drought, and which rain fell just previous to the Coshocton collection taken some twelve days later than the other samples of this basin.

Here, as elsewhere in 1899 observations, we do not obtain the high nitrates in the fall that were obtained in the last samples of the two preceding years owing to the absence in the present work of fall rains. The analytical results for November indicate unusually low, clear water for the season of the year simulating the usual September and October conditions.

Mineral Characters. Chlorine. (Plates 29 and 29a.) Owing to the prompt action on Mt. Vernon sewage and the consequent reduction in the quantity of free ammonia as previously stated, the extent of sewage pollution is not so well shown by that determination as has been the case almost without exception in the study of Ohio streams, but the best evidence of such a pollution in Kokosing river is given by the nitrites, bacteria, and chlorine. The latter determination so frequently modified in many Ohio streams by salt from ground sources or factory effluents seems to have been free from these disturbances in the Kokosing, and the chlorine curves may be taken as representing well the effect of introducing

the contents of Mt. Vernon's sewers into the water of Kokosing river. A distinct rise is seen each month—the smaller increase of May being due to the dilution from high water.

The findings below Wooster show the presence of sewage by their being constantly much higher than the mixed water of Apple creek and Big Killbuck would otherwise yield. On Killbuck above Wooster we have a chlorine fluctuating considerably, and evidently a portion of it comes from other sources than rural sewage, which is not strange since salt wells are known on the territory drained, although the wells are not now being worked.

The water of Apple creek comes from springs, and the surface drainage of a well cultivated section, and as the yield of the springs is nearly a constant factor, and as the results show lower chlorines in the lower stages of the stream, the investigation would indicate that the chlorine fluctuation is dependent on the surface drainage, and increases with the presence of direct surface drainage.

The chlorine below Mansfield is that of a slightly diluted sewage, while the findings above town are fairly satisfactory for a richly cultivated section except for the anomolous result in August, which is not understood. Aside from this August result the other chlorine findings departed but little from a mean. Of the various determinations made for this peculiar August sample some were close to the average for the season, while others were extremes, the chlorine and dissolved oxygen being the highest for the station, while the turbidity, oxygen consuming power, albuminoid ammonia, nitrates, and bacteria were at their lowest. The collector's note book records the observation "Bubbling like a spring," but why this bubbling should have occurred in the one sample when the other seven were collected within less than four feet of the same spot is not quite clear.

In connection with the population on the drainage area, and the weather conditions there is a lack of constancy in the chlorine of Black Fork above Shelby indicating some irregular pollutions of small extent, and in connection with the organic determinations it would seem they were from ground sources. The writer is informed deer licks formerly existed in that section. The very marked and never failing upward turn of the chlorine curves at Shelby is not to be taken as indicative of large additions of animal discharges from that village as is found by consulting the results for organic matter, but is attributable to the factory refuse from this manufacturing community (see next section) and of course the extent of the fluctuation of the curve is greatest in time of low water since the factory discharges would not be materially lessened in dry weather. At the time of this investigation but little household sewage reached Black Fork from Shelby as their sewer system was in course of construction and not completed.

In observing the "D" chlorine curves one notices that the Walhonding findings above Coshocton are higher in August, September, October, and November than at any other station on "D", but it should not be forgotten that the water of Mohican river represented by the "F" curves enters Kokosing river below the nearest station above Coshocton and that the chlorine character of "F" is well up in these four months of low water.

Alkalinity and Incrusting Constituents. (Plates 30, 30a and 33.) As the result of the introduction of the sewages of Mt. Vernon and Wooster the waters at those places showed a slight decrease in carbonates and some increase in the incrusting material. The water of Kokosing river was the most alkaline of any in the Muskingum system, averaging 192.0 parts above Mt. Vernon and 190.7 below, but the scale-forming element was low.

The effect of Mansfield sewage judged by the curve for averages was to make the water below town slightly softer than above, but the majority of the monthly curves show a different effect, and it is to be noticed that the average alkalinity is diminished by the two strikingly low and not accounted for findings below that city in August and September.

At Shelby the acid nature of the factory wastes is well indicated by the downward course of the alkalinity curves and the opposite direction taken by the incrusting constituents. This effect was of course most evident in the stages of low water reaching the highest figures in our tests for August, September, and November—the October sample not having been collected owing to the extremely low condition of the creek when the water merely stood in pools.

The figures for incrusting constituents in these three months, 327.6, 350.6, and 225.6 parts per million, give a scale-forming element much greater than previously found in this series of studies. The average alkalinity of 180.1 above Shelby was reduced to 98.8 below, and the incrusting average of 56.6 was increased to 176.4 (October results not in below town), which is a much greater change for the season than was found either in Wills creek at Cambridge, or in Blanchard river at Findlay where the greatest previous acid influences were encountered.

In view of the high sulphates and chlorides found in the northern portions of the Walhonding system, the low incrusting constituent average of 14.4 above Coshocton speaks well for the absence of scale-forming material in the waters received from the southern portion of the watershed, and this average at Coshocton is lower than for any other station on this branch of the Muskingum except above Mt. Vernon. The difference in the time of collection and the consequent difference in condition of the river should be borne in mind in comparing the Coshocton results for June or July with the findings of the other stations in those months.

Total Solids. (Plates 31 and 31a.) These curves follow the com-

bined chlorine, alkalinity, and incrusting constituent factors very well except when an excess of soil was being carried by high water e. g. at Coshocton in June, and in some of the May samples, especially at Mansfield and Shelby. The decrease in total solids from Killbuck above to below is as much due to the difference in proportion of mud carried as to the difference in mineral characters of those samples in July and November.

The incrusting constituents of Black Fork below Shelby are easily recognizable in the curves for solids in August and September.

Dissolved Oxygen. (Plate 23.) The utter inability of Killbuck creek below Wooster, and of Rocky Fork below Mansfield to meet the demands made for oxygen by the pollution of those places is shown by the falling off in the findings for dissolved oxygen at those stations. The oxygen character of Apple creek was helpful in the former case, but the extent of pollution was so great at Mansfield in proportion to the size of the stream that the average of 10.31 milligrams of oxygen per litre above that city was reduced to 4.10 below town while at the lower station only two findings were above 5 milligrams and only one above 5.70, that being in November under the influence of a cold rain. The minimum finding below Mansfield was 1.08.

Bacteria. (Plates 32 and 32a.) The July counts for Shelby, Mansfield and Mt. Vernon were lost. The work on this division of the Muskingum shows some marked increases in bacterial life following the heavy inflowing of surface washings after rains. All of the May samples (except above Coshocton taken previous to that rainy period) show high counts, some of them being higher than again appeared at their respective stations during the season. Other samples showing more or less rain disturbance were, June at Coshocton, and September and November at Shelby, Mansfield and Wooster.

The bacterial results on Kokosing river sustain the findings for nitrites and chlorine in giving evidence of sewage pollution from Mt. Vernon. The bacterial examinations agree with the other results in showing a general freedom from rain disturbances at the time of taking samples from the Kokosing river not usually met with in our river work.

The general increase in the number of bacteria at the station below Shelby would sustain the free ammonia findings in indicating the presence of some sewage influence from that community, and this probably came by surface drainage as they had no sewers at the time. It is interesting to note that the two months showing more bacteria above than below Shelby are two of the months during low water showing marked effects from acid pollutions, and the two months mentioned above as being influenced by moderate rains.

The Apple creek results show a good quality of water during low stages; but under circumstances causing the entrance of surface washings the effect from the highly cultivated and well manured soil of the area

drained is seen in the ready increase of microbic life. That there was not a greater inflection of the November curve at Wooster is due to the fact that the number of bacteria in a sewage polluted water, as below town, is not influenced by surface washings as a water unpolluted by sewage, like those above Wooster. The usual increase in the water at Wooster is very marked and shows a pronounced pollution at that point. On the "D" curves the higher counts of Killbuck stand out in contrast to the lower ones of Kokosing, but the extreme difference in September is brought about by rain influences at Wooster and not at Mt. Vernon.

Such decided jumps as are seen in the Mansfield curves when plotted to the *logarithms* of the number of bacteria instead of the numbers themselves is certainly strong evidence as to the foul condition of the stream below the city. It was thought by the writer in 1898, when making the examinations below Lima on Ottawa river, and below Bucyrus on Sandusky river, that the pollutions found there would not be equalled in this state except possibly in the Scioto below Columbus, but the average number of bacteria (242,200 per cc.) found below Mansfield is approximately 60 per cent. higher than the average below Lima, 70 per cent. higher than the average below Columbus, and more than double the average below Bucyrus.

The results on Waldhonding above Coshocton show, as do the chemical findings, that the long flow of the water after receiving its last sewage pollution furnishes much opportunity for purification. The distance above this station to the nearest urban sewage is some thirty-eight miles—Mt. Vernon being the nearest.

Some information as to the bacterial character of the waters of the Waldhonding system can be gained from the arrangement in the following table. The names of the stations are arranged in order according to freedom from bacteria as determined by the averages given in the second column. In the third and fourth columns are the minimum and maximum findings, and in the fifth column the rank of the station based on the lowest single finding.

Station and stream.	Average No. of bacteria.	Minimum.	Maximum.	Rank per minimum finding.
Mt. Vernon, above, Kokosing.....	434	160	950	1
Coshocton, above, Waldhonding.....	1,058	230	4,000	2
Mt. Vernon, below, Kokosing.....	1,843	750	4,900	8
Shelby, above, Black Fork.....	1,979	300	5,500	4
Wooster, above, Killbuck.....	2,031	500	4,600	5
Wooster, above, Apple.....	2,553	300	6,400	3
Shelby, below, Black Fork.....	2,800	700	7,000	7
Mansfield, above, Rocky Fork.....	3,021	700	5,700	6
Wooster, below, Killbuck.....	9,250	1,500	29,100	9
Mansfield, below, Rocky Fork.....	242,200	52,100	672,000	10

In the last column it is observed that the four stations located directly below places adding more or less sewage to the streams rank as 7, 8, 9, and 10, showing that waters so polluted do not under the more favorable conditions reach the low figures elsewhere attained.

SUMMARY OF WALHONDING SYSTEM.

Although the water of Kokosing river before it receives the pollution of Mt. Vernon, shows evidence of some impurities, still it must be considered as an unusually good water for an open stream in an inhabited section. While the addition of so large a proportion of sewage to so small a quantity of water as sometimes happens at Mt. Vernon, may result in a nuisance, yet purification processes rapidly ensue and the nuisance does not have opportunity to extend far from the vicinity of the sewers, and by the time the locality of our lower station was reached the water gave evidence of endeavoring to regain a good condition. There can be no question that the character of the Kokosing water exerts a beneficial action on the contents of other streams mixed with it at a later stage, and it is to be considered an important factor in bringing about the improved quality of water found above Coshocton. The results from Walhonding creek above the town named compare quite favorably with those of the remaining headwaters, viz., Apple and Killbuck creeks, Black and Rocky Forks of Mohican river, and show that in the long distance flows of from forty-eight to eighty-one miles the organic matter in the sewages of Wooster, Shelby, and Mansfield, has been well cared for by nature. The statement just made is not to be taken as meaning there is no organic material in the water above Coshocton, nor as meaning there is no possibility of danger from the sewage of the places named if the Walhonding water were to be used for drinking purposes. It so happens that the sewered villages and cities are chiefly located near the headwaters of the system and while their pollution is eventually cared for by nature yet the investigation shows that a sufficiently great amount of vegetative material is contributed along the course of the streams to keep the water above Coshocton from reaching as good a condition as it might.

While the upper portion of Killbuck creek furnished a water at all times containing much clay and vegetation yet it showed less fluctuation than the other streams when subjected to rainfalls. The conditions for oxidation are not favorable in Killbuck creek and while the character of the Apple creek water is helpful, yet the sewage of Wooster is not easily handled by nature, and in low water only with time and difficulty.

Aside from the Kokosing water, the Apple creek samples came the nearest to furnishing a good water, and while under favorable conditions the water of Apple creek at our station showed fairly well, yet even a moderate rain caused it to receive an increment of very questionable sanitary benefit.

The head waters of Black Fork are subject to considerable fluctuation and possess at all times a considerable amount of organic matter, chiefly vegetative. The additions to the stream at Shelby are certainly not to be classed as beneficial viewed from the standpoint of future usefulness of the water, but the water is not used for domestic purposes until it reaches Zanesville.

The addition of the raw sewage of Mansfield, including much household sewage and some very objectionable factory refuse, into so small a volume of water as is found at that point in Rocky Fork could not very well result in anything but a foul condition. The investigation proved the pollution below Mansfield to be the worst on the Muskingum watershed, and one which demands the treatment of the sewage of that city before it is emptied into Rocky Fork. At the present writing plans are under way for a sewage disposal plant at Mansfield.

4. NIMISHILLEN CREEK, TUSCARAWAS RIVER AND MUSKINGUM RIVER.

The reader should refer to the diagram on page 521, to get the relation of the tributaries to the main stream. East, Middle and West Branches of Nimishillen creek unite at Canton, and then empty into Tuscarawas river some thirteen miles above Canal Dover. Notice that Sugar creek, a tributary of some size enters between Canal Dover and New Philadelphia. Big Stillwater creek empties into Tuscarawas river just below New Philadelphia and nearly forty miles above Coshocton where the Tuscarawas river and Walhonding creek unite to form Muskingum river. Wills creek after a flow of some forty miles from Cambridge enters the Muskingum about twenty miles above Zanesville. Licking creek enters Muskingum between our Zanesville sampling points on the main river. The above are estimated distances by river. The introductory note on page 589 under the Walhonding discussion applies here as in no case were all of the samples for any month on curve "A" collected on the same trip, and thus several apparent discrepancies arise owing to different stages of the stream on the two trips.

The twelve stations for curve "A" were located as follows:—above Canton on West Branch of Nimishillen creek, the samples being taken (with two exceptions) from the race leading to the water works; below Canton on Nimishillen creek; above and below Massillon on Tuscarawas river; above Canal Dover, below New Philadelphia, and above Coshocton all on the Tuscarawas river; below Coshocton on the Muskingum; above and below Zanesville on the Muskingum, the upper station being located near the intake pipe supplying the city of Zanesville; and one each above McConnellsville and Marietta on the Muskingum river. On the upper curve of each plate arrows are placed to indicate the approximate location at which there enters a tributary previously discussed.

Physical Properties. The Nimishillen water shows a freedom from the objectionable appearances induced by the clay so prevalent in most portions of the Muskingum system. The findings above Canton are unusually good physically owing to the samples being taken from the race (except in May and November) and the Canton Waterworks Company endeavors to admit no roilly water to the race.

The odors obtained from none of the stations of curve "A" were entirely satisfactory, while the findings below Canton were bad except in April when it seems from the analysis that the water was less polluted. Although the results show the water above Coshocton to have been improved in many respects, yet the odors had not become fully acceptable.

In considering the turbidities we find no unusually bad results at Massillon, but by the time Canal Dover is reached the water has at all times (judged by our monthly samples) a distinct turbidity, and does not become clear above Coshocton even though those samples were taken under more favorable conditions for clearness on account of absence of rain influences. The water in the lower course of the Muskingum is apt to be roilly at any time owing to the fact that it is open to the disturbances from the local rains of many sections and tributaries. A little study of the combined sources of information in this report shows to what an unusual extent the city of Zanesville is afflicted with a disagreeable and unsightly water. The city is supplied with the raw water of the Muskingum river taken just above the city, and the results from our upper station represent the character of the water taken through the intake pipe. It is to be noticed that not once in the eight trials did we obtain a clear sample from that station. As regards a muddied drinking water, Zanesville is not simply between two fires but is rather surrounded by them. Our results indicate that when local rains were not adding the clay of the immediate vicinity to the water passing the intake pipe, there was present an undesirable amount of such soil from one of the following sources, the upper Tuscarawas, the roilly Killbuck, the dirty Big Stillwater, or the mud-bearing Wills creek. The clearest sample we obtained at the Zanesville intake would not permit the platinum wire of the turbidity stick to be visible beyond a depth of four inches, and while it is hoped that clearer waters do sometimes prevail, the results of our investigation show that under the present arrangement the citizens of that city have an opportunity of easily fulfilling the old adage and eating (drinking) a peck of dirt before they die.

Organic Matter. Oxygen required. (Plates I and 1a.) Portions of the May and June curves show the usual results of high water conditions. The middle of the May curve while still high is much lower than the ends. It must not be forgotten that there was a difference of one week between the two collection trips and that there were two floods in May. The upper six stations of the curve were sampled in the second period of high water, while the stations from above Coshocton to Mar-

ietta were visited as the water was subsiding from the first period of rain—the greatest finding appearing at the station (Marietta) nearest the mouth of the river, and the lowest above Coshocton where the river had about reached its normal state. In June the conditions were reversed in part so that the highest findings were obtained in the middle of the curve and especially at Zanesville and McConnelsville owing to the heavy local rains of June 20 and 21 around Zanesville and in the lower portion of the Walhonding basin. The Marietta collection was made before the full effect of the surface washings appeared. Other minor rises in the curves for oxygen required are seen in April, July, August, and September at Zanesville, and in November above Canton. The drop in the May curve below Zanesville agrees with the findings for turbidity and albuminoid ammonia in showing that the clear water of that date in Licking creek produced a beneficial dilution when mixed with the muddy water of the Muskingum.

The oxygen required shows a decided increase at Massillon and a study of these results with those for the dissolved oxygen and the two ammonias leads one to the conclusion that the sewage of Massillon is of different composition than that of the ordinary city. The excess of amounts for albuminoid ammonia and oxygen required with the diminished dissolved oxygen point to a pollution similar to that produced by the waste material from straw board factories, and as there is such a factory in Massillon it is evident some of its refuse was entering the stream. A direct comparison should not be made between the curves for Canton and Massillon for oxygen consuming power and albuminoid ammonia, and an opinion thereby formed of the extent of the sewage of those cities. The major part of the Canton sewage passes through a chemical precipitation plant which would decrease the amounts of albuminoid ammonia and the oxygen requirements otherwise shown.

Two factors cause the only downward turn of the oxygen required curve at Canton (in November,) viz., the low finding on the one hand below town, and on the other the conditions which led to the highest finding above town except in May. In May there was no water in the race owing to repairs, and in November the race was closed owing to the rain of the few days preceding. This rain had been light and followed a period of dry weather—the stream was not muddy as shown by the low turbidity, yet there was a marked increase in the organic matter showing that the quality of the West Branch Nimishillen water quickly depreciates on the addition of surface washings.

It should not be understood from the curve of averages that the drop in the middle of the curve is wholly indicative of purification changes, and that the river below Coshocton is again polluted to the extent the upward course of the curve would there seem to show: for, while much purification doubtless does occur above Coshocton, and while the contributions received below Coshocton from Wills creek

must raise the organic material in the Muskingum, yet a careful inspection of the rainfall tables for the observing stations situated on the drainage area of the Tuscarawas and its tributaries, bearing in mind the dates of the Coshocton samples, suggests that the Tuscarawas samples at the village named were free from surface washing effects to an unusual degree in seven of the eight months—and the results show it. The remaining sample (May) was not even an unusual sample as it was disturbed but little by rain effects. The June Coshocton sample below town received its rain influence from the Walhonding water.

Nitrogen as Albuminoid Ammonia. (Plates 2 and 2a.) These curves show the addition of organic matter at the various urban communities. The modifications due to rain disturbances are much the same as for the oxygen consuming power owing to the vegetative nature of the surface washings at such times, and were incidentally given in the preceding section.

There is not the wide variation in this curve one might at first anticipate at Canton, but it is because the sewage disposal plant deprives the effluent of much albuminoid ammonia although the finding is enough greater for this determination below than above town to give a good inflection of the curve.

The Massillon situation was discussed under the preceding section. At Canal Dover and New Philadelphia the curves for organic matter agree fairly well, and their fluctuations are within narrow limits, but there is a lack of constancy in the direction of the monthly curves which seems probably to have some connection with the introduction between the two villages of the water from the Sugar creek tributary.

From the curves for albuminoid ammonia and oxygen required, it would appear that the organic pollutions from Coshocton were practically as great as from Zanesville, but such is not the case. The river at the latter place is much larger and requires therefore more pollution to increase any determination a given amount. In addition, at each city an important tributary enters between the above and below town sampling places, but their influences are nearly opposite. The Licking water is so much freer from organic matter than the Muskingum, as shown by our examinations above Zanesville, that when the former empties into the latter there is a dilution of the Zanesville pollutions which have also entered the Muskingum, and the upward turn of the curves at Zanesville on plates 1, 1a, 2, and 2a is diminished and not commensurate with the pollutions of that city, if this dilution by Licking creek be overlooked. At Coshocton the Walhonding is so much richer in organic material than the Tuscarawas that the water of the latter plus the Coshocton sewage is still slightly superior in most respects to the former, and consequently the results are such below town as to be generally better than the Walhonding findings, although decidedly inferior to the Tuscarawas findings above Coshocton. In other words, considering the "A" curves, the en-

trance of the Wallhonding at Coshocton has a tendency to make the pollution of that village appear greater than it is, while the addition of Licking creek at Zanesville belittles the pollution there received from that city.

Nitrogen as Free Ammonia. (Plates 3 and 3a.) We have again in the free ammonia curves the best indication of the sewage condition of the water. With the exception of below New Philadelphia, which is accounted for later, the curves rise at the known points of pollution and fall by virtue of purification and dilution in the intervening spaces.

In the free ammonia results at Canton we find unquestionable evidence of the presence of household sewage. The chemical precipitation plant does not dispose of the free ammonia as it does of the matter supplying the oxygen required and albuminoid ammonia, consequently the departures of the free ammonia curves are quite evident and become very marked in low water, e. g., in August and October. The flat curve of May at this city was due to the high water, but why the April finding below town should have been so low is not understood, as the water was at normal height and the sewage of the city is not supposed to be intermittently delivered to the stream. Under the weather influences existing at the time the low results of both ammonias suggests a cessation for some cause from the sewage pollution.

The increase in the free ammonias at Massillon is surprisingly small considering the situation and size of the city, but on reference to the Engineer's report we find that only eight per cent. of the population are using the sewers, hence the sewage population of that city is less than that of Coshocton, and but a trifle greater than that of New Philadelphia.

The reason why the New Philadelphia sewage (Canal Dover had no sewers then) failed to produce more effect on the Tuscarawas water seems to lie in the dilution from the two tributaries emptying between these two stations. One of these streams, Sugar creek, drains a considerable area containing no special sources of pollution, and hence it would probably add a large quantity of good water to the river and counteract to a great degree the pollution of New Philadelphia, especially as the standard obtained above Canal Dover is not to be particularly commended for purity.

The sewage of Zanesville causes the curve to rise each month in spite of the previously mentioned dilution from Licking creek.

By the time the Muskingum has reached Marietta it compares favorably with the head waters above Canton and Massillon as regards the amount of organic matter contained, showing that the pollution and purification of the stream are about on the same footing. In this connection it is to be remembered that the generally low results above Coshocton are in part the outcome of a succession of samples usually free from rain disturbances and consequently lower in organic matter.

Nitrites and Nitrates. (Plates 4 and 5.) Like the results already discussed under the tributaries, we have in the main stream of the water-

shed owing to the absence of cold, fall rains, no such increase of nitrates in November as was obtained in the investigations of the two preceding years. The present curves are in general quite regular and show only a few fluctuations.

In general the low nitrates below Canton show that the natural process of oxidation had made but little headway with the sewage disposal plant's effluent in the short time after its reception into Nimishillen creek, but the increase in nitrites at the lower station would indicate transitional changes. In August the water below Canton was so low it had nearly ceased flowing, and as a result we find the sewage of the city had caused complete reduction of the nitrites and nitrates with a resultant high free ammonia. In August, June, and November the upper course of West Branch of Nimishillen furnished some higher nitrates, as such appeared at the upper as well as the lower station (remembering the reduction below the city in August). It is possible these might be in some way connected with the refuse from the Stark County Infirmary, but the data at hand is not sufficient to warrant stating the infirmary to be responsible for the variations.

Mineral Characters. Chlorine. (Plates 6 and 6a.) If we were compelled to depend upon the chlorine alone for evidence of the presence of household sewage we should have a difficult task in curve "A" owing to the presence of salt from manufactory sewage and ground sources. Aside from the results at Canton, the actual amounts of chlorine found were not very helpful in tracing domestic sewage influences. At the city named the chlorine jumps agree well with those for free ammonia and the bacteria, and show marked effects from sewage, especially in the lower stages of the stream, the maximum findings being in August and October. The results above Canton are a little irregular and, like other findings at the same station, are not readily interpreted with the information at hand without causing suspicion of the benefits derived from certain washings or drainage on the West Branch of Nimishillen creek.

All of the above Massillon findings show the effects of the wastes from the salt works at Rittman and Wadsworth, and the decrease to the determinations found below town is helped by the additions to the stream at that city.

The decrease in chlorine at Coshocton is due to a diluting action from Walhonding creek, but the findings there, in this respect, as well as the other mineral characters, suggest that the waters of the two streams forming the Muskingum had not become well mixed at the station below Coshocton, and possibly the samples from that station contained more Tuscarawas than Walhonding water. At Zanesville we find again a great diluting tributary in Licking creek although the sewage of the city located at the mouth of Licking serves to prevent much of a reduction in chlorine. Below Zanesville are known sources of salt from ground sources causing a small rise by the time McConnelsville is reached, after which dilu-

tion causes a slight reduction in the amount of chlorine to appear above Marietta.

Alkalinity and Incrusting Constituents. (Plates 7, 7a, and 8.) The softening influence of rain water is nicely brought out in the low depression of the June curves at Zanesville and McConnelsville, the flat curves for May and the somewhat flattened ones for April, while in drier weather the curves are higher and much more broken.

In general, the sewages of Canton and Coshocton harden the river water, while those of Massillon and Zanesville exert a softening influence. At the last named city the decrease in hardness comes in part at least from the wastes of the large soap factory situated there. The below Zanesville station shows a reduction from the combined hardness of the above town stations on Muskingum river and Licking creek.

The averages give the hardest water below Canton, and the softest below Zanesville, although the latter was not as soft as that in the Big Stillwater tributary.

The decrease in incrusting constituents at Coshocton in September is apparently the result of the difference in volumes and incrusting constituents of the two streams at that time. Tuscarawas river was low in volume but high in sulphates and chlorides, while Walhonding was high from a recent rain and nearly free from scale forming elements.

As a whole the water of the Muskingum river is softer than that of the Olentangy, Scioto, Sandusky, and Maumee streams, and nearly as soft as the Mahoning water. The stations of curve "A", save in the northern portion, Canton and Massillon, do not show the limestone influences found in the tributaries entering the Muskingum from the northwestern part of the watershed.

Total Solids. (Plates 10 and 10a.) In a water analysis the total solids are frequently taken as an approximate measure of the mineral matter contained, and in clear waters they generally agree closely with the sum of the alkalinity, incrusting constituents, and the chlorides (when the chlorine is not in combination with magnesium or calcium), but the solids of this stream are wholly misleading if taken as indicators of the hardness, since there was so much suspended matter present. To illustrate, the May samples were uniformly soft, yet the curve for solids was not low—being kept up by the soil then carried by the water. Again on curve "A" the lowest average total hardness was below Zanesville, and yet the curve of averages for total solids contains but one higher point than that for the station below Zanesville, while in no total solid curve but April do we find that station occupying the lowest point. The most of this suspended matter producing such discordant results between the solids and hardness is in the form of clay. The extreme clay disturbance is found in the lower course of the river in our June samples when the water was so turbid as to practically hide the wire as soon as well immersed. At this time Wills creek was also on a rampage, and therefore emptying a very roilly water into the Muskingum river above Zanesville.

The great jump below Massillon in August is due to suspended matter which was removed by ignition. This same sample yielded the lowest dissolved oxygen, and the highest albuminoid ammonia obtained there during the season, and the oxygen required then was high for the low condition of the stream undisturbed by surface washings, all these factors indicating the presence of organic material from a straw board factory.

Dissolved Oxygen. (Plate 9.) The none too pure condition of the water above Canal Dover, with the dilution from the water of Sugar creek which is presumably fairly pure, causes at New Philadelphia a flat curve, but otherwise the entrance of pollution is shown by a drop in this curve as appears at Canton, Massillon, Coshocton, and Zanesville. The decrease below the last named city would have been greater but for the dilution from Licking creek, and the exposure to atmospheric oxygen as the water passed over the dam just above the mouth of Licking creek, and later in the rapids of the Muskingum just below the mouth of Licking.

The fall in the curves at Canton is of course largely due to sanitary sewage, but the drops at Massillon are but partially due to sanitary sewage, the straw board factory refuse playing, as it does, a very active part in removing the free oxygen from the water.

The highest findings for dissolved oxygen, as revealed by the curve of averages, were above Canton, Coshocton, and Marietta—the amounts of these being nearly equal but decreasing slightly in the order given. The small general decrease from Coshocton to Zanesville is consistent with the known quality of Wills creek which enters at that portion of the course.

Bacteria. (Plates II and I Ia.) The influence of rainfall and subsequent surface washings in increasing the number of bacteria in the purer places and decreasing the number per given quantity of water in the more polluted places, results in the flattened curve for May. Local rain influences are seen in June at Zanesville and McConnelsville, while various minor fluctuations occur.

The bacterial results show very nicely sewage effects at all the places of such pollution, viz., Canton, Massillon, New Philadelphia, Coshocton, and Zanesville, while the influence was greatest below the first named city in low stages of the stream.

The extent of the jumps at Coshocton is considerable and shows a marked pollution provided the two streams were well mixed at the time of sampling, as referred to under chlorine.

Below New Philadelphia while the nitrates had increased slightly there was not in the face of the Sugar creek dilution much evidence of New Philadelphia sewage to be obtained from the other determinations, but we find the bacterial data showing well such addition of sewage for each month during the season. It would seem that the bacteria with their power of self-multiplication had, in the favorable environments of sewage pollution, increased to such an extent that when the Sugar creek dilution reduced the other indicators to nearly the same level found in the water

above Canal Dover, there still remained an increase in the number of bacteria.

From the curve of averages it is readily seen that the lowest bacterial content of this water was above Coshocton. Though part of this freedom from germs is the result of sampling when the stream was not disturbed by rainfall, yet some credence must be given to the possibilities of purification since only minor pollutions occur below New Philadelphia, and Uhrichsville, and these villages are about forty and thirty-eight miles respectively above Coshocton by river. The generally low average above Coshocton is a consistent feature since that one station in five out of the eight months had the lowest number of bacteria for the stations of curve "A", the exceptions being in April, August and October.

The following table gives the minimum, maximum, and average findings for the sampling places on the Muskingum and its tributaries, with the rank of each station reckoned upon the average number of bacteria in the water and again upon the minimum findings. When the name of the station is printed in *italics* it is to show that all or a part of the public supply is derived from the stream there examined.

Station and stream.	Rank by averages.	Rank by minimum.	Average No. of bacteria.	Minimum No. of bacteria.	Maximum No. of bacteria.
Coshocton, above, Tuscarawas.....	1	2	366	120	650
Mt. Vernon, above, Kokosing.....	2	3	434	160	950
<i>Newark, above, Licking</i>	3	1	700	95	2,000
Marietta, above, Muskingum.....	4	4	981	170	3,900
Coshocton, above, Walhonding.....	5	6	1,058	230	4,000
<i>Cambridge, above, Wills</i>	6	14	1,546	350	4,070
McConnelsville, above, Muskingum....	7	15	1,597	350	7,000
<i>Uhrichsville & Dennison, above, Big Stillwater</i>	8	7	1,805	240	6,800
Mt. Vernon, below, Kokosing.....	9	22	1,843	750	4,900
Shelby, above, Black Fork.....	10	12	1,979	300	5,500
Wooster, above, Killbuck.....	11	16	2,031	500	4,600
Cambridge, below, Wills.....	12	24	2,231	950	4,400
Zanesville, Ice field, Licking.....	13	10	2,250	275	14,200
Canal Dover, above, Tuscarawas.....	14	17	2,350	650	6,000
<i>Canton, above, Nimishillen</i>	15	21	2,369	750	7,800
<i>Wooster, above, Apple Creek</i>	16	11	2,553	300	6,400
Zanesville, above, Licking.....	17	8	2,696	250	15,200
Uhrichsville & Dennison, below, Big Stillwater	18	9	2,700	250	10,500
<i>Zanesville, above, Muskingum</i>	19	5	2,744	200	15,900
Shelby, below, Black Fork.....	20	20	2,800	700	7,000
Mansfield, above, Rocky Fork.....	21	19	3,021	700	5,700
Massillon, above, Tuscarawas.....	22	13	3,078	325	8,000
Coshocton, below, Muskingum.....	23	23	4,300	800	14,900
Newark, below, Licking.....	24	25	5,162	1,300	9,600
New Philadelphia, below, Tuscarawas.	25	26	6,200	1,500	19,500
Wooster, below, Killbuck.....	26	27	9,250	1,500	29,100
Zanesville, below, Muskingum.....	27	18	11,969	650	47,400
Massillon, below, Tuscarawas.....	28	28	16,500	6,900	29,200
Canton, below, Nimishillen.....	29	29	94,800	8,000	314,000
Mansfield, below, Rocky Fork.....	30	30	242,200	52,100	672,000

While the station above Cambridge and that above Uhrichsville and Dennison is found fairly well toward the right end of the list, yet the number of bacteria obtained was much in excess of what a good drinking water should contain; and furthermore these waters had objectionable features other than the bacteria they contained. The rank of the above Canton, above Wooster (Apple creek), and above Zanesville (Muskingum) stations is such as should make the citizens of those cities earnestly desire the exclusion of such surface waters from their public supplies. It should not be a comforting thought to residents of a community that the surface water added to their supply contained on the average approximately 10,000 bacteria in a teaspoonful of water, and yet such is the revelation from eight samples taken in as many months. Some relief comes from finding the water at the Zanesville intake pipe did in one sample reach a low enough figure to entitle that station to fifth place, judging the rank by minimum findings, but unfortunately the count there was respectably low only twice in our eight trials. Viewed by the minimum finding the race water at Canton takes twenty-first rank and shows the inadvisability of using the race water with the present existing conditions up stream.

Certainly the average number of bacteria found at any one station as the result of eight examinations made monthly is not too severe a standard of purity to expect of the waters of that system, and yet taking for such an easy standard the average (366) above Coshocton on the Tuscarawas river, it is found that more than 87 per cent. of all the samples from the remaining twenty-nine stations on the Muskingum and its various tributaries contained a greater number of bacteria. The bacterial results show as do the chemical findings that in the more favored portions of the Muskingum watershed the water attains a greater degree of purity than does the waters of those Ohio streams previously reported upon by the Board.

FINAL SUMMARY OF MUSKINGUM WATERSHED.

QUALITY OF WATERS USED FOR DRINKING PURPOSES.

The results of the investigation show that the policy of the Canton Waterworks Company in excluding water from the race after rainfalls is a good one, but it is shown that the exclusion of Nimishillen creek water from the race and public supply at all times would be a better policy.*

During the period of the investigation of the waters of the Muskingum system two other water companies began operations to avoid the use of very undesirable surface waters, viz., at Cambridge, and at Uhrichsville and Dennison where a joint supply is in operation. At the

Since the conclusion of the Muskingum investigation an additional source of supply for Canton has been secured which yields a very good water, and thus there should be no call to use the race water.

latter place mechanical filters have been established and these should remove without trouble the objectionable features from Big Stillwater creek and afford the villages of Dennison and Uhrichsville a good potable water. At Cambridge the use of Wills creek water is to be discontinued and the supply taken from wells which have yielded samples indicative of satisfaction to the consumers. The results of the examinations show how greatly such improvements were needed.

The village of Wooster ought if possible to avoid drawing any of the raw water of Apple creek into its supply, for while the water of that stream is not so bad in dry weather (owing to the presence of springs) yet as soon as surface washings are felt the increase in organic matter makes the water defective.

The results above Newark on Licking creek are such that the taking of water from that stream to supplement the regular supply is a procedure not to be praised, but is open to less objection than the similar practice at Wooster.

The investigation warrants the putting forth of most strenuous efforts in the location of a new supply for the city of Zanesville, or the installation of a proper method of treatment for the present supply if no other is available. The people of that city, and those stopping there temporarily, should not be called upon to drink in the raw condition a water which has received the sewage (or sewage effluent) of thirty-one sewered institutions, villages and cities, containing a sewage population of nearly 28,000 people, besides the surface drainage from many additional thousands.

POLLUTION AND PURIFICATION.

The data collected by the engineer together with the results exhibited in the foregoing pages of this report, and especially those obtained from the samples collected at the twelve stations situated just below communities making contributions to the streams, leave no room for doubt as to whether the Muskingum and its tributaries receive pollution. These streams certainly do receive pollution. Then the question arises, "To what extent is nature able to counteract the addition of this undesirable material from man and his agencies?" The question is more easily handled if we divide the large Muskingum watershed into three portions as follows, viz., *a*, the Walhonding, *b*, the Tuscarawas (including Nimishillen and Big Stillwater creeks), and *c*, the Muskingum proper (including Licking and Wills creeks). By such a division we have a station located at the mouth of the stream in each of the subdivisions, and in each case the flow for some distance above the last station is free from any gross pollution, thus insuring thorough mixing and a sample representative of the conditions. Since finding on looking at the result that the purer waters were obtained from the stations located at the mouths of these subdivisions and at the headwaters we have only to consider the

analytical findings at the extremities of the subdivisions to get an idea of the efficiency of the purification. It is not our intention to convey the idea that no pollution occurred above the places chosen as headwater stations for there doubtless was some, but it was of a minor character and not concentrated at any given place.

A. Walhonding System. The station at the mouth of the stream is the one above Coshocton, while there were 5 headwater stations, one each on Apple creek, Killbuck creek, Kokosing river, Black Fork, and Rocky Fork. The averages above Shelby, Mansfield and Wooster on Black Fork, Rocky Fork and Killbuck creek show waters inferior in quality to the average above Coshocton, while the opposite is true for the averages above Mt. Vernon on Kokosing river, and above Wooster on Apple creek. Taking into consideration the drainage area of these streams and their consequent volumes, it must be said that the water above Coshocton compares favorably with the water in the upper courses. The major sewage pollutions occur near the sources of the tributaries, and thus while the small volumes of water there found lead to bad local results, yet the long flow to the mouth of the Walhonding gives opportunity for disposal of that sewage matter before Coshocton is reached. However, enough organic material of a vegetative nature is contributed along the course of the streams to keep the water from regaining the purity shown in the better headwaters.

B. Tuscarawas River and Tributaries. The station at the mouth of this division is the one above Coshocton, and the results are better there than at any other station on the division, and in fact were improved upon in the whole watershed only at the stations above Newark and above Mt. Vernon. Of the three headwater stations of this portion (above Canton, Massillon and Uhrichsville), none show good waters, and each one has received a little household sewage and some other pollution. While the improved results above Coshocton are in part due to absence of surface washings in the samples there taken, yet we cannot help but say there has been much purification, and after a close study of all the details we come to the conclusion that in general the purification by natural processes on this subdivision of the Muskingum watershed is in excess of the pollutions introduced in the area covered by our analytical work.

C. Muskingum Proper (Including Licking and Wills Creeks). With the water of the Walhonding above Coshocton equal in purity to that of its headwaters, and with the water in the Tuscarawas above Coshocton superior in quality to that obtained from any station above it, it is perfectly fair to include these two stations as headwater points for the third of our subdivisions. The results of these two stations above Coshocton are decidedly better than the findings above Marietta (the station at the mouth of the stream), and there is, therefore, no hesitancy in saying that the pollution of the Muskingum beginning with Coshocton

is in excess of the natural purification which ensues before that river empties into the Ohio river. In confirmation of this statement we find the water of the third headwater station of this division (at Newark, above Licking creek) is still freer from impurities than either of the above Coshocton stations. There is a fourth headwater station (Wills creek, above Cambridge), but the findings there are some worse than at Marietta and we feel we have no data for saying Wills creek ever had an original purity, and we consider it better to view that tributary in its entirety as one of the pollutions of the lower Muskingum.

Therefore, in considering the whole watershed of the Muskingum river, we find the water at its mouth superior in quality to that found at four headwater stations, inferior to that of three others, and about on a level with that of three more; and thus the ratio between purification and pollution varies for different portions of the system, yet it is approximately on the whole equal to unity.

There are some gross local pollutions on the streams of this system, yet the long periods of flow and the large amount of drainage area render such beneficial results that the Muskingum is to be considered as a purer stream than those previously examined by the Board, viz., the Scioto, Olentangy, Mahoning, Maumee, and Sandusky rivers.

REPORT UPON A SANITARY SURVEY OF THE MUSKINGUM WATERSHED.

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ENGINEER OHIO STATE BOARD OF HEALTH.

SYNOPSIS.

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I. INTRODUCTION.

SCOPE OF WORK.

It has been attempted on the work of this watershed to go more into detail,—to make the inspections more complete than in the work of last year. It was the intention to personally inspect every city and village and every isolated industry, the waste from which could in any way affect the character of the water. Then in this inspection, which would necessarily compel the inspector to travel over the entire territory, the general topographical, geological, and agricultural character of the country could be noted. During the first part of the year the above program was faithfully carried out, and a complete personal inspection made; as the season drew to a close however, it was seen that this method could not be continued and the work completed in the allotted time, owing to an unusual amount of work which the engineer was called upon to do outside of the watershed inspection. It then became necessary to find some method by which the work could be shortened and still the value of personal inspections not be lost. For this purpose, blanks requesting information concerning the population, number of school-children, number of voters, industries, and drainage of each village and the location and drainage of all neighboring industries, were sent to every health officer and township clerk in the unfinished area. These blanks were fairly well filled out and returned so that the inspection of many small villages, having absolutely no industries whatever, was saved, and the location of many industries was definitely fixed, thus saving many useless trips. In but few cases were villages containing as many as 200 people left without a personal inspection. The idea of the scheme was to prevent a waste of time on villages, containing a store and several houses only, which are in every respect merely a bringing together of a few farm houses. All cities and villages except as above noted were visited, their populations estimated, and the sewerage, drainage, industries, and water supplies investigated, and inspected. Maps were prepared of the sixteen towns above and below which monthly samples of water were taken. These maps show the location of all sewers and industries with special reference to the points at which the samples were taken.

In addition to the towns and scattered industries all isolated public and private institutions, such as asylums, infirmaries, children's homes, colleges, etc., were visited and their water supplies and sewerage investigated.

It was impossible to locate every portable sawmill in operation, every country cheese factory, every country slaughter house, and every coal bank in the mining section, but it is believed that all of the important sources of pollution and many of the unimportant ones have been located

and investigated. The size of the watershed gone over, 7797 square miles, prevented as close an inspection as was desired, but the work is educational and as large a territory as possible must be brought under its influence. It is preliminary now so as to lay a good foundation for more detailed work in the future. In inspecting industries no attempt was made to investigate accurately the amount of polluting wastes as the work was on too general a scale and the inspector had no authority to force admission to factories and compel the giving of statements as to the amount of material used; in many cases this would gladly be furnished but in many it would not, and the work was not attempted.

Another new feature of the work has been the inspection of the ice supplies; this could not be carried out as satisfactorily as was first hoped but it is believed that a start has been made.

In addition to the sanitary inspection all dams have been located and their size and character noted, also the extent of any water power which they may furnish. The location and description of the dams and their pond areas was necessary for a proper study of the watershed, and while the engineer was on the ground it was thought advisable to inquire into water power, especially when it was intended to make a brief study of the run off of the stream.

The public water supplies were all inspected and will be reported on separately; as will be seen later but few have any connection with the watershed and the pollution of its streams as nearly all the supplies are from subsurface and deep-seated sources.

METHODS OF WORK.

The methods used in making the inspection were briefly as follows:—On entering a town a visit was paid to the health officer or a prominent physician, if the former individual did not exist, and all the information possible concerning the drainage and industries of the place and vicinity obtained. In cities of course visits were made to the city engineer for information concerning maps of the sewers, and the superintendent of the waterworks for information concerning the public supply. After obtaining all the data possible in this way inspections were made and the reports corrected and revised.

No surveys beyond rough reconnaissances could be made and the accuracy of maps could be but seldom questioned. In many cases maps had to be taken from antiquated county atlases and brought up to date by the above rough methods. The industries were located and their nature and the nature of the wastes briefly noted; the outlets of sewers located, and the number of people tributary to them obtained by consultation with sanitary police, the superintendent of the waterworks, and the city engineer. In a large number of cases no records of any kind are kept concerning the public improvements and data must be laboriously obtained from the memory of the local engineer and from

the "oldest inhabitant." In a few cases accurate records are kept and the work was very much lessened and the accuracy greatly increased.

In small villages, a consultation with some intelligent citizen and a mere passage through the place were sufficient. In the case of large institutions a consultation with the superintendent and an inspection of the drainage were all that was necessary.

From the beginning of the investigation in June until the middle of October the work was mainly done on a bicycle. Headquarters were established in some convenient town and the surrounding country visited on a wheel, the railroads being used wherever convenient. In large cities also the bicycle was found very convenient. During bad weather when the roads were too muddy, resort was had to a carriage. In this way a greater part of the watershed was gone over, especially all the more level portions where the wheeling was fair, leaving the hilly southern part for the latter part of the season when the weather would not admit of the use of a bicycle. It was found that much better work could be done on a bicycle when the weather and roads permitted of its use. A good cyclometer was attached to it and in connection with a road map it was found very easy to make rough surveys.

Some of the territory which required a more careful inspection was gone over on foot which of course is by far the best way to do the work if the time and the area to be gotten over are in keeping with this method.

II. GENERAL DESCRIPTION OF WATERSHED.

AREA.

For the determination of the area of the watershed and its subdivisions the State Board of Health Map of Ohio was used, corrected, however, from local maps and field notes. The areas were measured with a polar planimeter set to read to tenths of square miles, and the results checked to one-fifth of a square mile. It must not be supposed that the areas given are correct to the latter figure as the watershed lines vary much more than that amount.

The following table gives the area of the total watershed and the subsidiary watersheds together with the areas of the more important minor tributaries.

TABLE I—WATERSHED AREAS.

Watershed.	Square miles.		
Walhonding Creek —			
Killbuck Creek		608	
Mohican River —			
Black Fork	580		
Jerome Fork	324		
Minor tributaries	67		
Total		971	
Kokosing River		473	
Minor tributaries		167	
Total			2,219
Tuscarawas River —			
Big Stillwater Creek.....		472	
Sugar Creek		356	
One Leg Creek.....		260	
Sandy Creek —			
Nimishillen Creek	170		
Minor tributaries	288		
Total		458	
Minor tributaries		944	
Total			2,490
Licking Creek —			
North Fork		235	
South Fork		288	
Minor tributaries		230	
Total			753

TABLE I — WATERSHED AREAS — Concluded.

Watershed.	Square miles.		
Wills Creek —			
Salt Creek		152	.....
Leatherwood Creek		90	.....
Minor tributaries		568	.....
Total			810
Muskingum River —			
Wakatomika Creek		235	.....
Jonathan Creek		304	.....
Salt Creek		161	.....
Meigs Creek		135	.....
Olive Green Creek.....		83	.....
Wolf Creek		220	.....
Minor tributaries		287	.....
Total			1,525
Grand Total			7,797

These figures do not agree very closely with any others published except those of Mr. Hazen, made for the Board, but it is thought that they are as nearly correct as can be made with the present maps. When the new survey of the state is completed the areas of the watersheds can be determined very accurately. Owing to the changes in the map, on account of more detailed information, a new table was prepared of the watersheds tributary to those cities and villages classed as urban, which will be given in the discussion of the question of pollution.

The Muskingum watershed lies entirely within the State of Ohio, and includes the greater portion of the eastern half of the same. It includes all of Wayne, Holmes, Coshocton, Muskingum, Tuscarawas, and Guernsey counties; the greater part of Richland, Ashland, Stark, Carroll, Harrison, Morgan, Licking, and Knox counties, large sections of Morrow, Medina, Summit, Belmont, Noble, Washington, and Perry counties, and small portions of Portage, Columbiana, Monroe, Athens, and Fairfield counties; in all, the whole or portions of 26 counties.

GENERAL TOPOGRAPHY.

The surface of the Muskingum watershed is influenced so much by glacial action that it is necessary to divide the area into two divisions, the glaciated and unglaciated portion. The glaciated portion including, roughly, the territory north and west of Carroll, Tuscarawas, Coshocton, and Holmes counties, is composed of smooth rolling plains cut into only by the broad stream valleys, while the remaining portion is hilly and abrupt, with the streams flowing in beds cut into the native rock.

Influenced by the nature of the soil and condition of the surface, agriculture is in a much more flourishing condition in the northern and western portion of the watershed than in the southeastern. In the first mentioned part the soil is composed of the glacial drift and is very deep, and as a rule fertile. Through this section wheat is a large and important crop, the stream valleys also furnishing much corn. These same sections at one time also supported large herds of stock, sheep and cattle, but this industry declined with the falling prices of wool and beef only to be revived again in the last year or so with the rise of the market. The unglaciated portion of the watershed with its poorer soil formed from the disintegration of the native rock does not furnish such a good field for agriculture except in the stream valleys where there are long strips of alluvial deposit which yield enormous crops of corn. This section also roughly corresponds to the mining districts of the state, a fact which has also tended to decrease the agricultural value of much of this land.

The fertile fields of the northwestern part of the watershed have been stripped of timber to make room for agriculture and the hills of the southeast have provided much timber for use in the mines. Through both of these sections there are still to be found a few good patches of timber and much scrub, the latter along the streams and hillsides where agriculture is difficult. As a rule the most timber is to be found between these two sections where it is neither required for the mines nor its room required for crops. The southern part of Ashland and Wayne counties, the western part of Tuscarawas, and all of Holmes and Coshocton counties probably include the heaviest wooded areas of the watershed. There is also much timber left in Washington county and the southern portion of Morgan.

GEOLOGY.

There are but two formations included in the Muskingum watershed—the carboniferous, taking in all the central and eastern portion, and the sub-carboniferous, including a small portion in the northwestern part and a strip along the western edge. The first division comprises the coal measures and the conglomerate group, and the latter, the sub-carboniferous limestone and the Waverly groups. The exact boundary of these formations is shown on Plate 16.

But little of the sub-carboniferous group outcrops as it is almost entirely covered with the drift, while the carboniferous group lies almost entirely in the unglaciated portion and is thus not covered over. Plate 16 shows the glacial boundary as determined by G. F. Wright. As seen above, this line divided the watershed into two widely different areas, the northwestern part consisting of rolling agricultural land and the southeastern of a less desirable rough and hilly country.

The glaciated portion is traversed by broad shallow valleys cut in the soft drift. The streams of this section flow over gravel beds, and, from the better covering of the soil with vegetation, carry much less clay

and mud than do the southern streams. The rivers of the unglaciated section have been cutting in the bed-rock, for many ages, deep valleys for themselves, containing principally clay and loose rock and but little gravel, and the bordering hills support so little vegetation, that the streams are nearly always turbid, and after heavy rains carry an enormous amount of clay.

Special attention must be called to the mining districts on account of their influence on the pollution of the watershed. The mining industry will be noted in the references to the various cities and villages in the chapter on pollution. From this it will be seen that the district in general includes the southwestern half of the watershed. More in detail, it includes the following counties and portions of counties that are within the watershed, no attention being given to portions outside of same—the southeastern part of Medina, western part of Summit, eastern part of Wayne, southern and western parts of Stark, all of Columbiana, western part of Carroll, all but the central part of Harrison, all of Belmont, practically all of Tuscarawas, all but the northeastern part of Guernsey, all of Noble, eastern part of Holmes, nearly all of Coshocton, central and southern parts of Muskingum, eastern part of Perry, and nearly all of Morgan. Through the sections named above there are scattered more or less extensive coal mines and banks, and in general through the same territory, on account of cheap fuel, many tile, pottery and brick plants.

DRAINAGE.

The Muskingum watershed is drained by the Muskingum River which has four main tributaries,—Licking Creek, Wills Creek, Walhonding Creek, and the Tuscarawas River, the two last named streams uniting at Coshocton to form the Muskingum River proper. The main drainage line of the watershed is the Tuscarawas and Muskingum Rivers, the former rising in the northern part of the watershed and the latter emptying into the Ohio River at the lower end. The Tuscarawas River drains the eastern half of the upper part of the watershed, Walhonding Creek, the western half of this same part, and the Muskingum River with Wills Creek to the east, and Licking Creek to the west drains the lower part and handle of the fan-shaped watershed.

The pre-glacial drainage of this area was along lines entirely different from the present ones. It is claimed that the Muskingum River turned to the west at Dresden and flowed through the Licking Creek valley to the Scioto River; some claim that the latter river flowed east through this same valley, then north through the Muskingum, Tuscarawas, and Cuyahoga basins into Lake Erie. It is established that the Muskingum River did not have its present outlet. Some of the facts which led to this opinion are the traces of a large channel through Licking valley, the small size and newness of the present Muskingum River channel south of Zanes-

ville, and the deep channel of the Tuscarawas to the north, where in many places the bed rock is lower than that of the Muskingum to the south.

In the glaciated portion of the watershed there are many minor changes suspected, very few of which have been authenticated, however.

The following table shows the approximate gradient of the main streams and their more important tributaries:

TABLE II—APPROXIMATE GRADIENT OF PRINCIPAL STREAMS.

Stream.	From	To	Distance in Miles.	Total Fall in Feet.	Average Fall per Mile.
Muskingum	Mouth	Zanesville	70	106	1.5
Muskingum	Mouth	Coshocton	99	180	1.8
Muskingum	Zanesville	Coshocton	29	74	2.6
Muskingum and Tuscarawas	Mouth	Headwaters	211	530	2.5
Tuscarawas	Coshocton	Canal Dover	47	110	2.4
Tuscarawas	Coshocton	Headwaters	112	350	3.1
Stillwater	Mouth	Tippecanoe	16	23	1.4
Stillwater	Mouth	Headwaters	47	392	8.3
Licking	Zanesville	Newark	23	134	5.8
Licking	Newark	Headwaters	33	399	12.0
Licking	Zanesville	Headwaters of North Branch	56	533	9.5
Wills	Mouth	Cambridge	46	69	1.5
Wills	Cambridge	Headwaters	35	201	5.7
Wills	Mouth	Headwaters	81	370	4.5
Walhonding	Coshocton	Headwaters Killbuck ..	54	230	4.3
Walhonding	Coshocton	Headwaters Black Fork.	92	635	6.9
Walhonding	Coshocton	Headwaters Kokosing..	62	365	5.9

As is seen from this table the fall per mile along the main drainage line, the Muskingum and Tuscarawas Rivers, is very small and the flow sluggish. This is especially true of the Muskingum River and also of the lower part of the Tuscarawas. The fall per mile of the lower part of both Stillwater and Wills Creeks is in keeping with their almost lack of current. This is only shown, however, in the lower portions as the fall is so great in the hills which form their head-waters that the average for the whole stream is brought up to a very good figure.

This same feature is shown, but to a less marked degree, in all the streams, and it is gradually becoming more pronounced as the water cuts back into the hills at the head-waters and spreads the debris out over the valleys below. This general silting up of the lower channels is greatly interfered with by the large number of dams on the watershed, each one of which holds back, from every flood, a large amount of sediment which would have been distributed along the whole channel. Tiling has also

decreased the amount of sediment, as in well-drained fields the rain-water soaks in and goes off in the tiles instead of washing out gullies on the surface. In the hilly portion of the watershed where there is the greatest need of protecting the surface from washing, agriculture is but poorly developed and many good farms have been ruined. In some of the abandoned mining districts, where the timber has been cut away and the ground exposed, the hills have been cut into by such enormous gullies that it seems as if it would be impossible to ever reclaim them. There are thousands of acres in the mining districts of this watershed from which every bit of soil has been stripped. Nature will require many years for the restoration of these waste lands, especially if not intelligently assisted by man.

In the northern and western parts of the watershed the fields are well tiled and ditched. In fact nearly all the swamp land has been reclaimed, the only extensive area still in existence being a strip along the Killbuck Creek between Wooster and Shreve. All through the watershed there are many small areas which, from lack of drainage, are quite swampy in wet years, but as a rule the drainage of the watershed is good, too good in fact for the preservation of the summer flows of the streams.

III. POPULATION.

The work of compiling and estimating the population of the watershed for this year is very unsatisfactory. The only reliable datum to work from is the census of 1890, just nine years old now, which in all but rural districts is very far from correct. In estimating the urban population the same method as formerly used in this work is employed. The rate of growth of the towns is determined from the censuses of 1870, 1880, and 1890, and from any other reliable census that can be secured; the figure thus obtained is modified by estimating the population from the number of voters, school children, and in small towns from the number of houses, all the time taking into account any extraordinary increase or decrease for industrial reasons. In some cases data for only one of the above methods can be secured, while in others all may be used. It is intended to obtain a fair conservative estimate of the population for 1899.

In estimating the rural population the following method was used: The population of each township and of each village in the township were taken from the 1890 census, the village populations subtracted from the township population, then the estimated population of the villages for 1899 added to the difference, thus giving a fair estimate of the total rural population. This method assumes that only the scattered rural population remains constant and gives a closer estimate than the method formerly used.

On the borders of the watersheds the township population was divided according to the areas in each watershed and the village populations added in the proper place.

In making the division between rural and urban populations the same figure as formerly used is employed, namely, classing all towns with an estimated population of 1,000 or over as urban, and those below as rural. This figure is of course arbitrary, but it is believed to be the best that can be selected if the idea is kept in mind that this division is made for the purpose of keeping in one class all the towns the drainage from which causes more or different pollution than that from a rural population.

On this watershed there are thirty-nine towns, each with an estimated population of 1,000 or more; twenty-eight of these have public water supplies and more or less sewerage which must necessarily be increased as the demand for modern conveniences increases. On the other hand there are four small villages which have public water supplies

but with the above division are not classed as urban. If 2,000 were taken as the dividing line ten of the eleven towns classed as urban, but without public water supplies, would enter the rural class, but this latter class would include seven other towns having public water supplies making eleven in all, and this would defeat the end to be accomplished.

Following the methods outlined above it is found that the total population on the watershed is 596,841, of which 372,974 are classed as rural and 223,867 as urban.

The following table gives the population for the different subsidiary watersheds and the average population per square mile:

TABLE III—POPULATION ON WATERSHED.

Total population.				Population per square mile.		
	Urban.	Rural.	Total.	Urban.	Rural.	Total.
Walhonding Creek	46,082	96,151	142,233	21	43	64
Tuscarawas River	98,691	138,092	236,783	40	55	95
Licking Creek	22,186	32,936	55,122	29	44	73
Wills Creek	9,500	38,996	48,496	12	48	60
Muskingum River and minor streams	47,408	66,799	114,207	31	44	75
Total	223,867	372,974	596,841	29	48	77

The average urban population per square mile is 29, which corresponds more nearly with 25 for the Sandusky watershed than with 52, the figure for the Maumee watershed. The rural population is 48 per square mile, which is higher than for either the Sandusky or Maumee watershed which were 38 and 44 respectively.

The total population per square mile of the Muskingum is 77 which is between those for the Sandusky and Maumee, 63 for the former and 96 for the latter. The large figures for the Maumee watershed are due to the city of Toledo and not to any widespread thickly populated district.

The rural population of both the Tuscarawas and Wills Creek watersheds is brought up by the large scattered mining communities and it may be larger than given, as it is impossible to estimate accurately this floating population. The total for Wills Creek is cut down by the very small urban population. The three other subsidiary watersheds represent more nearly the average condition for the state.

IV. POLLUTION OF WATERSHED.

A. SOURCES OF POLLUTION.

Before taking up the specific sources of pollution a short review will be given of the factors to which the pollution is due. These factors may be roughly divided into the following classes: farm drainage, sewage of towns and public institutions, drainage from dumps, and industrial wastes, of which the last three are of the most importance, though the first must not be neglected by any means. As regards the liability to contain undesirable bacteria, farm drainage is more dangerous than industrial wastes; its immunity from complaint is due to its great prevalence and its wide distribution in small amounts; while manufacturing refuse, on the other hand, is not of such general occurrence and is found in larger quantities in each place, and is therefore more noticeable.

Farm drainage but seldom causes a nuisance and is not detrimental to fish life, while manufacturing wastes as a rule cause a nuisance and destroy water life.

The drainage from dumping grounds and the dumping of refuse into streams cause a pollution of such a varied degree that a general statement is very difficult to make; in most cases, however, this matter is objectionable.

The most serious of all, however, is the sewage proper from towns and public institutions. In the studies of the rivers of the state it has been found that in only exceptional cases does a stream recover its original purity after being polluted by sewage, and it has been accepted as an axiom that a stream once having received unpurified sewage cannot again furnish a potable water.

With the above general statements regarding the factors in the pollution of a watershed, each will now be considered more in detail.

FARM DRAINAGE.

The drainage from rural districts has several objectionable factors, many of which are found to a more marked degree in urban districts and hence are apt to be neglected in this class.

The excrementitious matter from domestic animals, as found in manure on fields, heaped up in barnyards and hog pens, and scattered over city streets seriously pollutes the run off of rain storms. This has been recognized in urban districts by the many attempts to divert the first part of the storm water into the sanitary sewers for disposal, but few, however, consider this as a polluting factor in rural districts. It is

customary to locate the stock yards and pens near the streams and creeks for convenience in watering the animals, thus bringing the objectionable matter right to the banks of water courses ready to be washed in by the first rain. In districts where a great deal of stock is raised or where the fields are highly manured, the small streams are frequently colored a deep peaty brown after rains from the leachings from this matter.

On isolated farms surface privies are frequently used, and as the contents of these accumulate they are spread out on the ground to be oxidized or washed away by rain, while in the more thickly settled communities vaults are used and the surface water is kept free from pollution at the expense of the ground water.

Garbage and slops are invariably fed to hogs or chickens, so they enter into this problem as well as the wastes of animal economy.

Another polluting feature of rural life is the waste products of the winter slaughtering done on nearly every farm. The facilities for this work are of necessity crude and everything but the meat itself finds its way to the streams, while in regular slaughter houses much of this refuse is utilized.

SEWAGE.

As stated above, the sewage from towns and public institutions is by far the most important factor in the pollution of the streams of a state containing as many large towns as Ohio. In many places it is difficult to determine the amount and character of the sewage, owing to the general absence of records.

As a rule the sewage of a town is of no importance unless that town has a public water supply in general use, and in many cases it is then but of little importance owing to the slowness with which sewers are built. It can be stated that almost never do the sewers keep pace with the water mains, and even where the sewers are available, the householders are not compelled to connect with them. Inspection of Table 4 will show the small per cent. of the population of towns having public water supplies that have access to sewers and the still smaller per cent. connected to the same.

As nearly all the towns of this watershed have the combined system of sewers, the sewage contains much objectionable matter washed in from the yards and streets. If the streets and alleys drain rapidly they are apt to receive much filth from washwater and slops which are thrown on them as the easiest method of disposal. The sewers receive also a good percentage of the objectionable industrial wastes.

The sewage of the public institutions is of more importance than would appear at first sight. These institutions consist of the county infirmaries and children's homes, and of the asylums, reformatories, colleges, etc., nearly all of which are provided with a water supply under pressure, and their buildings equipped with water closets. The sewer receives the discharge from these closets, also from the laundry, slaughter-

house and kitchen, so that an institution with 100 inmates is responsible for more true sewage than towns of ten times this number of people, and frequently than much larger places still. In nearly every case the sewer is run to the nearest water course and the sewage discharged without any attempt at purification. There are three notable exceptions to this statement—Denison College at Granville, the Massillon State Hospital, and the Mansfield Reformatory, which places have installed efficient disposal systems.

In a few places the sewage is emptied into cesspools or old gravel pits and none finds its way direct to the streams. Owing to the large amount of land generally available and the compactness of the sewer system, it would be a very easy matter for these isolated institutions to put in a disposal system and avoid the pollution of the streams.

DUMPS.

The solid and semi-solid refuse, composing the garbage, street sweepings, and night soil of all the towns of the watershed is disposed of by dumping and burying in out of the way places and by dumping over the banks of streams. The practice of dumping refuse of any kind whatever into streams and on their banks is filthy and shiftless in the extreme and should be entirely prohibited. This method reaches its maximum of barbarity when night soil is dumped bodily into the streams to save the expense of cartage. In innumerable cases ashes, kitchen refuse, manufacturing wastes, etc., are dumped on the banks of streams, forming unsightly heaps which gradually accumulate, and leach and wash into the stream with every rain until high water sweeps everything away to deposit it on some bar or in the back-water of some dam below.

Frequently night soil and dead animals are buried in shallow trenches within the reach of high water which washes off the covering of the ditches and sends much of their contents into the streams.

Another practice, almost as bad, is that of spreading night soil on the fields during the winter and leaving it exposed to the wash of rains until spring when it is plowed under.

Dead animals are used for the manufacture of fertilizer, soap, etc., in a few cities, and this very objectionable pollution is thereby reduced considerably.

Kitchen garbage in rural and in the majority of urban districts, in this watershed, is fed to hogs, either by each individual householder, in the small places, or collected in wagons and hauled to farms outside, in the large towns.

Dry refuse, as paper, straw, ashes, street sweepings, etc., when dumped in low land removed from the water-courses, causes but little pollution, especially if the dump is burned over occasionally and not allowed to waste away by decay only. This burning will probably cause more of a local nuisance than the decaying process, but it is only for a

short time and is a necessary evil if this method of disposal is used. Ashes, free from all other refuse, can be used for fill without causing any pollution or nuisance. Street sweepings can be used for fill on land which will be cultivated, but should not be dumped on city lots as it contains a large percentage of organic matter which is already in the process of decaying.

INDUSTRIAL WASTES.

The Muskingum watershed is not what could be called a manufacturing district; it is agricultural in the north-western portion and mining in the south-eastern, with a certain amount of agriculture in this section also. All the large towns support considerable general manufacturing, and the rural districts are dotted with saw mills, flour mills, cheese factories, creameries, cider presses, etc.

Much detailed information has been given in sanitary literature upon the character of the wastes from the various industries and but a brief summary will be necessary here. The industries furnishing objectionable wastes may be classified according to whether the principal of these wastes is vegetable, animal, or mineral matter. The first class will include breweries, cider mills, canning factories, distilleries, straw-board works, wood-working shops, etc.; the second, creameries, cheese-factories, slaughter houses, soap and rendering works, tanneries, woolen mills, etc.; the third, mines, gas works, metal-working shops, etc. The objectionable waste from laundries and dyeworks is both animal and vegetable and it could hardly be classified with any separate class.

Breweries:—Their objectionable waste consists of the wash water containing more or less malt and hops which decay very rapidly and form a very offensive sewage.

Cider Mills:—The pollution is caused by the drainage from decaying piles of pumice or from throwing the latter bodily into the streams.

Canning Factories:—The pollution is caused by the wash water and by throwing the refuse matter into the streams or where it can drain to the same.

Distilleries:—The wash water and refuse corn and rye form the principal objectionable matter.

Straw-board Works:—The refuse from this industry consists of large quantities of water carrying the glutinous parts of straw, lime used for extracting the former, and small particles of the straw itself. This forms a very objectionable pollution when turned into streams; it kills the fish, gives the water a very foul odor, and at the same time discolors it badly. As the matter in suspension settles out it is deposited along the streams in decaying masses.

Wood-working Shops:—The refuse from these is often piled up in large heaps and left to decay and leach away into the streams increasing their organic matter though very seldom causing a nuisance of any kind.

Creameries and Cheese Factories:—The refuse from these consists of the wash water which carries with it a certain amount of milk. In small quantities it is not objectionable but in large amounts, especially when it is not carried off rapidly, causes an objectionable pollution.

Slaughter Houses:—The amount of refuse from these places varies widely with each one. In the modern establishments the only refuse is carried off in the wash water, while in the primitive ones there is a large amount of solid matter, offals, etc., in addition to the waste water. Whichever it is, the refuse is highly putrescible and causes a serious pollution when admitted to the streams.

Soap and Rendering Works:—The refuse from these consists of scraps of animal matter and wash water bearing the same. Soap works also send in mineral matter, but it is not nearly as objectionable as the animal, in fact it helps reduce the effect of the latter.

Tanneries:—The most objectionable refuse from this industry consists of the animal matter which accumulates in the cleaning and tanning vats and which is from time to time emptied into the most convenient water course. If the glue stock, hair, and scraps are not disposed of at once they also cause trouble.

Woolen Mills:—The kind of refuse from these mills varies; if raw wool is used there is a large amount of animal matter obtained in the first cleaning in addition to that used by every mill in the making up of the wool, which process also uses a large amount of vegetable and mineral matter in dye stuffs, mordants, etc., a large portion of which is wasted in the wash waters.

Mine Drainage:—The large number of coal mines in the eastern and southern portion of this watershed gives considerable importance to this source of pollution. This water, as it is pumped from the workings, frequently contains large amounts of sulphur and iron in solution much of which, on contact with the air, is deposited in the streams. While these minerals cause no nuisance they effectually destroy the potability of the water. The mine drainage also frequently contains a great deal of refuse from the animal economy and is objectionable on that account.

Gas Works:—These plants, engaged in the manufacture of illuminating gas from coal or oil, have considerable objectionable refuse, consisting of the tars and oils, by-products of the process, and much of which is emptied into the streams, both destroying the potability of the water and causing a nuisance.

Metal Working Shops:—The refuse from this class of work consists mainly of the acids used in cleaning the metals and the oils used in working up the same. None of it seems to cause a nuisance except indirectly by killing the fish, but the potability of the water is destroyed.

In summary it may be said that the easily decaying vegetable, all the animal, and but few of the mineral refuses cause a nuisance, while nearly all the industrial wastes, if present in any considerable quantity, make the water unfit for public supplies. On the other hand as soon as

these latter wastes are diluted, mixed through the water, and lost to taste and sight, the water has usually recovered its potability, while the pollution due to sewage is dangerous long after the water has recovered its physical qualifications. The mineral character of the water is frequently changed by industrial wastes and the desirability of the water for a public supply lessened, though not its potability.

This test, which can be so easily applied, makes the pollution due to industrial wastes much less serious than that from sewage even if for a time the former may cause more of a nuisance. If, however, dangerous bacteria are present, the introduction of organic manufacturing refuse may furnish such food as will prolong their life if not increase their number.

B. AMOUNT OF POLLUTION.

I. LOCATION AND AMOUNT OF ALL THE ABOVE MENTIONED SOURCES OF POLLUTION.

In giving the amount of pollution a brief description of each of the larger towns will be given together with its industries, sewerage, and any special cause of pollution. With the small villages frequently the mere stating of the estimated population and the chief industries, if there are any, will be sufficient. Many of these small places are given merely because they are found on the maps and not from their own importance. Under suitable headings any special pollution prevalent in certain districts will be noted.

These various sources of pollution will be taken up by each subsidiary watershed beginning at the mouth of the Muskingum River and going up stream, bringing in each watershed in its turn. A complete description of the sewer system of those towns having public water supplies will be given in condensed form in the summary of this section so as to make them easy of reference. Only the number of people using the sewers will be given through this general report on pollution.

The public water supplies will be described later though notes will be given on the private well supplies of the principal towns in connection with the report on pollution.

All cities and villages on small tributaries of the five main streams of the watershed will be given under the headings of these streams, and if they drain to large branches of these they will be taken up under the said tributary.

Five main streams make up the complete watershed in the following order which is given here for convenience of reference:—

- a. Muskingum River proper and minor tributaries.
- b. Licking Creek.
- c. Wills Creek.
- d. Walhonding Creek.
- e. Tuscarawas River.

a. MUSKINGUM RIVER.

Marietta. Population 12,500. This city is located at the mouth of the Muskingum River occupying both banks and extending up the same for some distance. It is the county seat, has considerable manufacturing, a public water supply, and a fairly good sewer system, but it bears little relation to this watershed as all of its sewers empty into the Ohio River, from which river it also obtains its water supply. Much of its surface drainage and the waste from some of its industries is to the Muskingum River, however. These industries consist of a chair factory, brewery, planing mills, a water power and a steam flour mill, vinegar works, and a glue factory, the last two of which are on the banks of the Muskingum River just above the city.

Private wells are used but little, there are a few dug ones that get water from the river gravel.

Washington County Children's Home:—This institution is located one mile north of Marietta on the bank of the Muskingum River. It has about 50 inmates and 10 officers and attendants. It has a sewer direct to the river into which is emptied the drainage from baths, laundry, and kitchen, but none from water closets, outdoor privies being used entirely. The water supply is from wells and cisterns.

Devols:—Population 20. This village is near the government dam which supplies power for a small grist mill, the only industry of the place.

Rainbow—Population 10.

Churchtown—Population 20.

Lowell—Population 400. It is located near the government dam which supplies power for a grist mill. Other industries found here are a creamery, saw mill, and a plow handle factory.

Claytona—Population 10.

Crooked Tree—Population 40.

Equity—Population 10.

Coal Run—Population 300. This is a broken down village supported by coal mining.

Beverly—Population 650. This is one of the old time river villages with but little chance now for growth. Its industries consist of two flour mills, a saw mill, and a planing mill which are supplied with water power from the government dam above town, and a steam flour mill and a small woolen mill. Its water supply is from private dug wells which reach the gravel at the river level.

Waterford—Population 80. This is a railroad station for Beverly across the river, it has a planing mill and a handle factory.

Wolf Creek—This is quite a stream draining a large section of both Washington and Morgan counties, the latter by its West Branch which separates from the main stream just west of Waterford.

Ormston—Population 5.

Watertown—Population 250. It has a water-power grist mill and a planing mill.

Wolf Creek—Population 10. There is an abandoned water-power near this post-office.

Brown's Mills—Population 40.

Patton's Mills—Population 25. This village has a good water-power grist mill.

Bartlett—Population 300. It has a saw and a grist mill. This village is on the edge of the watershed and some of its drainage may go south.

Plantsville—Population 50. It has a saw mill and some coal is mined near by.

Chesterhill.—Population 600. This village is supported largely by the oil territory to the west and south. It also has a grist mill and an old creamery. The water supply is from private wells dug through sand and soil into a blue sand 14 to 40 feet down.

Shinn—Population 10.

Todds—Population 20.

Huffman's—Population 5.

Elliott's—Population 40.

Westland—Population 10.

Pennsville—Population 300. It has a creamery which usually runs the year around.

Rosseau—Population 50.

Ringgold—Population 60.

Stubbs—Population 10.

Morgansville—Population 75.

Halls Valley—Population 5.

Triadelphia—Population 75. The industries of this village consist of a grist mill and lumber shipping.

Portersville—Population 100. There are coal mines in the vicinity.

Big Olive Green Creek—This stream and its branches drain portions of Morgan and Noble counties.

Ridge—Population 15.

Reinersville—Population 100. There are coal mines in the vicinity.

Moscow—Population 30. There is an abandoned water power in the vicinity.

Keith—Population 25.

Rich Valley—Population 5.

Haga—Population 25.

Olive Green—Population 50. Grist mill.

Sharon—Population 180. Planing mill.

Muskingum River. Populations on watershed of—

Center Bend—Population 10.

Hackney—Population 20. There is a saw mill here.

Meigs Creek—This creek drains the eastern part of Morgan and small portions of Muskingum and Noble counties.

Millgrove—Population 50. It contains an abandoned water-power grist mill.

Neelysville—Population 75.

Meigsville—Population 100.

Bristol—Population 100.

Sand Hollow—Population 10.

Wood Grove—Population 25.

Knight—Population 25.

Young Hickory—Population 40. Saw mill.

Coal Hill—Population 10.

Zeno—Population 25.

Renrock—Population 20. Grist mill.

Meigs—Population 20.

Cloud—Population 50.

Rowland—Population 20. Saw mill.

Museville—Population 30.

Muskingum River. Populations on watershed of—

Beckett—Population 10.

Luke Chute—Population 10. This is a government lock station.

Roxbury—Population 20. Saw mill.

Stockport—Population 450. The industries consist of a water-power grist mill at the government dam and a sawmill. This village is a center for the collection of produce and the distribution of merchandise for a large section of country.

Hooksburg—Population 25.

Morgan County Infirmary—This institution has a total population of 60 and is situated three miles south of McConnelsville just back from the river. Its water supply is from springs and wells piped to buildings. The institution has no sewer, dry earth closets and vaults being used entirely. Garbage and refuse are fed to hogs and chickens.

McConnelsville—Population 2,500. This village, the county seat of Morgan county, has recently introduced a public water supply and is now putting in a number of sewers. The sewage from 60 people together with all surface water drains direct to the Muskingum River. The industries consist of a planing mill, water-power grist mill at the government dam, and several small cigar factories.

Malta—Population 900. This village is directly opposite McConnelsville and formerly consisted of nothing but a railroad station for the latter place. It now has several industries, among which are a plow works, cigar factory, brick yard, tannery, and planing mill.

Morgan County Children's Home—This is located just above Malta and has 31 children and 12 officers and attendants. The water supply is from dug and driven wells, the former being pumped to the buildings.

which are sewered to the river. It is estimated that the average number of persons using the sewered closets is 20.

Rokeby Lock—Population 5. This is a government lock station opposite Eagleport.

Eagleport—Population 80.

Durant—Population 25. There is an abandoned salt works located here. This is one of a number of old works scattered along the river.

Cedar Run—Population 20.

Gaysport—Population 150. Grist mill.

Blue Rock—Population 100. This village has a coal mine and a grist mill.

Philo—Population 600. This is an old town, the only industry of which is the shipping of a little sand. Its water supply is from nine public wells dug down through sand and gravel to the coal 14 to 90 feet down.

Duncan's Falls—Population 200. There is a water-power grist mill at the government dam.

Salt Creek—This stream drains the eastern part of Muskingum county.

Keifer—Population 25.

McDonald—Population 10.

Carlwick—Population 50. Some coal mines are located here.

Chandlersville—Population 250. It has three flour mills, a saw mill and several small coal mines.

Freeland—Population 25.

Sonora—Population 200. A flour mill is located here.

Bridgeville—Population 30. It is an old National Road station.

Sundale—Population 100. This is the railroad station for Norwich.

Norwich—Population 250. Flour mill.

East Greenwood—Population 10.

Brush Creek—This is a small stream draining a coal and clay district in the southern part of Muskingum county.

Stoverton—Population 200. It has four potteries and tile works, a flour mill, and an old tannery.

Dillon—Population 200. Six coal mines are near by.

Jonathan Creek—This is an important tributary of the Muskingum River, draining half of Perry, the southwest corner of Muskingum, and a small portion of Licking counties. The eastern portion of its watershed, drained by the South Fork and Buckeye Fork, is a rich coal mining, tile, and pottery district, while the western portion drained by Jonathan Creek proper is an agricultural district. The water power on this stream was formerly very extensive, but has now dwindled to two small grist mills.

South Fork of Jonathan Creek. Populations on watershed of—

Roseville—Population 1,000. This village has grown rapidly in the last few years from the development of its potteries. It now has five

large potteries and two brick yards supplied with clay and coal from the local fields. The town is dirty, poorly drained, and supplied with poor water from shallow wells dug in the sand and gravel.

Crooksville—Population 800. This is even a newer town than Roseville, and has been developed in the same way by its potteries, of which there are four, and several small coal mines. The town is poorly drained, its streets are dirty, and muddy, and its houses poorly built. Its water is from shallow wells, dug through loam into sand.

McLuney—Population 150. It has a grist mill and coal mines near by.

Sayre—Population 30. It has a saw mill.

Lyonsdale—Population 10. There is a small coal bank in this place.

Moxahala—Population 150. This was once a flourishing mining and pottery town, but all these are abandoned now, and the place is at a stand still.

Jonathan Creek. Populations on watershed of—

Powells—Population 25. It has an old water-power grist mill.

White Cottage—Population 300. It has tile and pottery works and a water-power grist mill.

Opera—Population 10.

Hopewell—Population 150. Coal mining exists here.

Mt. Sterling—Population 100. Coal mining exists here.

Fultonham—Population 450. This is really two villages, the old one back on the hill and a new one at the railroad station on the creek. Here are located a saw mill, grist mill, and two large brick plants.

Buckeye Cottage—Population 150. This contains a pottery.

Redfield—Population 200. There are four coal mines near here.

Sego—Population 20.

Wesley—Population 10.

Mt. Perry—Population 150.

Somerset—Population 1,200. This town is on the divide, part of it draining to Rush Creek; the estimated population in the Muskingum watershed is 1,000. Somerset was formerly the county seat, but its inaccessibility lost for it this distinction, and it is now a quiet country village. Its industries consist of a saw mill, planing mill, and cigar factory.

Chalfonts—Population 30.

Glenford—Population 75. This is a railroad junction.

Linnville—Population 100. Saw mill.

Brownsville—Population 250.

Gratiot—Population 200. It has a tile works and a creamery.

Muskingum River. Populations on watershed of—

South Zanesville—Population 400. This is a suburb of Zanesville not yet incorporated. Its industries consist of coal mines, a pottery, a foundry, and stave factory.

Zanesville—Population 24,008. This, the second city in the watershed, is an important manufacturing town, and, as is usually the case with this class of cities, its public improvements are not of the best. It obtains a poor quality of water from the Muskingum River just above town, but is now discussing some method of improving the supply and this objectionable feature may be done away with in the future. Its sewer system is not extensive, only 40 per cent. of the population having access to and only 5,000 using the same. One redeeming feature, however, is a number of well-paved streets. Its principal industries are four large tile works, brick yards, a blast furnace, rolling mill, agricultural implement works, coffin factory, soap works, fertilizer works, tannery, four breweries, artificial ice plant, woolen mill, cotton mill, lumber yards and mills, flour mills, packing house, and many minor plants of various kinds. Several of the above factories are supplied with water-power from the government dam opposite the city and from a private dam at the mouth of Licking Creek.

Notwithstanding the poor water supplied by the city, the private supply is limited to a few dug wells in the western section. These wells are from fourteen to twenty feet deep, and obtain their water in sand and gravel.

Garbage and night soil is hauled to the country and disposed of in the most convenient manner; much of the latter seriously pollutes the streams by being left on hand for long periods before being buried, or plowed under.

Licking Creek enters the Muskingum River at Zanesville and Wills Creek enters above Adams' Mills, but these watersheds will not be taken up until the Muskingum and its minor tributaries are completed.

Gilbert—Population 10.

Ellis—Population 10.

Adamsville—Population 350. It has a grist and a planing mill.

Dresden—Population 1,400. This was a very important town during the height of river and canal navigation, but its growth stopped with the decline of that system of transportation. It was the outlet for the products of the fertile land above, and also made up much of the raw material brought in, especially the wool and corn, making a famous whisky from the latter. It now has a number of industries, among which are: a water-power and a steam woolen mill, a distillery, rock plaster works, planing mill, brick yard, and tile works.

The drainage is entirely surface, and to the Dresden side cut from the canal, Wakatomika Creek, and the Muskingum River. Vaults are usually dug about 15 feet deep down to gravel, so that they will not have to be cleaned.

The water supply is from private wells, both dug and driven forty feet deep into gravel. Dresden is the third largest town in the watershed without a public water supply.

Wakatomika Creek—This is a widely branching stream draining quite an extensive fertile valley, which includes portions of Muskingum, Licking, Knox, and Coshocton counties.

New Moscow—Population 200. Two saw mills.

Willowbrook—Population 50.

Wakatomika—Population 75.

Cooperdale—Population 50. This is the railroad station for West Carlisle.

Tunnel Hill—Population 50. Grist mill.

Frazesburg—Population 750. This is an old canal town. Its industries consist of a tile mill, planing mill, and canning factory. The drainage is through ditches and a few tiles to Wakatomika Creek and the abandoned canal. Water is obtained from shallow wells dug through the surface clay into gravel and sand below.

Black Run—Population 25. The stone quarries in the vicinity ship from this point.

West Carlisle—Population 300. This contains a buggy factory and saw mill.

Portable Saw Mills—The southwestern portion of Coshocton county contains many of these plants which are going through the country cutting up all the best timber.

Perryton—Population 150. Saw mill, and is a good shipping center.

Reform—Population 25.

Fallsburg—Population 150. Grist mill.

Frampton—Population 25.

Bladensburg—Population 250. There are two old water-power grist and feed mills here, but their power is nearly played out.

Muskingum River. Populations on watershed of—

Trinway—Population 300. This is a railroad junction.

Adams Mills—Population 100. There is a good water-power flour mill at the canal lock. A great deal of ice is shipped from here which has been cut from the canal basin below.

Conesville—Population 150. There are coal mines in the vicinity.

Franklin Station—Population 100.

Coshocton—Population 5,000. This village, the county seat of Coshocton county, is situated at the point where the Tuscarawas River and Wallhonding Creek join to form the Muskingum River.

Its sewers and surface water are drained almost entirely to the latter stream, however. The industries consist of four large advertising novelty works, a steel plant, strawboard works, basket factory, planing mills, and flour mills. The refuse from all of these reaches the Muskingum either through the sewers or ditches. Coshocton has the separate system of sewers, the sanitary part of which reaches 65 per cent. of the people, and to which the sewage of 1,500 is now sent.

The public water supply is from wells near Walhonding Creek, and is in general use. A few private wells are still in use; these are dug or driven, and find water in the gravel at the river level.

Garbage is dumped over the river bank to be carried off by high water. Night soil was formerly dumped in the same place, but this has been stopped, and it is now hauled to the country.

b. LICKING CREEK.

This large creek drains nearly all of Licking and parts of Knox, Fairfield, Perry, and Muskingum counties. The broad western part of the watershed is fairly level agricultural land, and the narrow eastern part is very hilly and not so well adapted for agriculture.

Muskingum County Infirmary—There are one hundred and thirty inmates and seven officers and attendants here. The buildings are supplied with Zanesville water for general use, but a seventy foot drove well supplies drinking water. Everyone uses sewered closets, the drainage from which, with that from the laundry, baths and kitchen, goes direct to Licking Creek. The slaughter house drains to a ditch leading to the creek.

Pleasant Valley—Population 50.

Irville—Population 150.

Nashport—Population 150. This is an old canal town.

Shannon—Population 25.

Cottage Hill—Population 25.

Tobosco—Population 75. Sandstone is quarried here and ground up for sand. There is an old dam located in Licking Creek at this place, which was part of the old canal system.

Rocky Fork—This is a small creek draining four townships in Licking county and a portion of Knox county.

Hanover—Population 300. There is a brick yard here.

Wilkins—Population 150. There is a wagon works here.

Purity—Population 50.

Rocky Fork—Population 25.

Long Run—Population 10.

Martinsburg—Population 350. It contains a saw mill. This village is on the divide between the Licking and Walhonding, and some of its drainage may go to the latter creek.

Licking Creek. Populations on watershed of—

Clay Lick—Population 120. It has an old broken down water-power.

Licking County Children's Home—This home, having a population of 98, is just east of Newark, from which it gets its water supply. Every one has access to sewered closets which drain direct to the creek.

Newark—Population 20,386. The city of Newark, the third of the watershed, is situated at the junction of the South Fork with the stream proper, Raccoon Creek also joining the South Fork within the city limits.

The industries of Newark consist of two glass factories, several large foundries and machine shops, a stove foundry, soap factory, brewery, distillery, artificial ice plant, railroad shops, gas works, and bent works.

The sewers and the surface water drain to both forks of Licking, to Raccoon Creek, and to the canal. The combined sewers are now used by about 3,000 people, though many more have access to them.

Private wells furnish a good deal of water yet as the public supply is not in as general use as it should be. These wells are usually driven down through clay into gravel thirty feet below. Garbage is dumped in the old canal bed in the eastern part of the city and along the creek banks. This filth, together with the sewage and the refuse from several slaughter houses near the creek, make them foul during low water, and the nuisance is seriously complained of.

Raccoon Creek—This creek joins the South Fork of Licking Creek in Newark and drains about three townships to the west of that city.

Granville—Population 1,800. This figure on the population includes a number of students at Denison College, as some are present the year round. The village is supported entirely by the college, the only industry being a small flour mill. Granville has a public water supply from wells, which is used by a good percentage of the town and also by the college. Private wells are both dug and driven through the surface soil and clay to a stratum of gravel thirty feet below.

Granville has no sewers beyond a few tiles for storm water, and so a number of houses have put in cess-pools into which the water closets are drained.

Denison College—This college, together with an affiliated school for women, is situated just within Granville village. Both colleges have a combined attendance of about 300, including instructors. The buildings are supplied with water from Granville, but have a private system of sewers leading to a filtration bed under-drained to Raccoon Creek. Only about 200 of the total attendance have access to these sewers, the remainder using outdoor vaults. Six private houses on the line of the sewer are connected with it, and are included in the above figure.

Ash—Population 10.

Alexandria—Population 400. This is an enterprising village with the following industries: a halter and rope works, saw mills, a grist mill, cider mill, and poultry dressing establishment.

Concord—Population 10.

Johnstown—Population 700. The commercial interest is large here as it is the collecting and distributing point for a large section of farming country. Other industries are a grist mill and a brick and tile works.

South Fork of Licking Creek—This stream drains the southern portion of Licking and small sections of both Fairfield and Perry counties.

Union Station—Population 75.

Licking County Infirmary—This institution has seventy-four inmates and seven officers and attendants. The domestic water supply is.

from a thirty-foot dug well and that for general use is pumped from springs. About thirty-five of the occupants use sewered closets, which with the laundry and kitchen are sewered to Remp Creek.

Jacksontown—Population 200. Cider mill.

Atherton—Population 30.

Hebron—Population 350. This is an old canal town, its industries at present consist of a saw mill, grist mill, and tile works.

Reservoir—Population 25. This is a railroad station for excursion-ists to Licking Reservoir.

Thornport—Population 100. This is the railroad station for Thornville. There is a cider mill near by.

Thornville—Population 500.

Millersport—Population 250. This is an old canal town.

Outville—Population 125. Saw mill.

Kirkersville—Population 350. Grist mill.

Etna—Population 250. Small cider mills and portable saw mills are numerous in this section.

Pataskala—Population 700—The industries consist of a saw mill, grist mill, and the collecting and shipping of large quantities of milk to Columbus. The water supply is from private wells driven 18 to 20 feet into gravel. Vaults are usually cleaned out, but some follow the general rule of digging new ones when old ones are full.

Columbia Center—Population 200.

Jersey—Population 150. It contains a carriage factory and a cider press.

Beech—Population 100.

Licking Creek. Populations on watershed of—

Fredonia—Population 150.

New Way—Population 75.

Vanatta—Population 100.

Norman—Population 150. Saw mill.

Highwater—Population 50.

St. Louisville—Population 300. This is a large chicken shipping point.

Appleton—Population 110. There is a saw mill here.

Utica—Population 800. This village is the shipping point for a large district engaged in raising live stock, the other industries are a water-power and a steam flour mill, a planing mill, and a washing machine factory. There are two good sewers, for surface drainage, emptying into the creek. Many privies are provided with boxes which are cleaned out when necessary.

The water supply is from private wells both dug and driven through the surface soil and muck into gravel eleven to twenty-four feet down.

Homer—Population 300. It has a saw mill and wagon shop.

Lock—Population 35.

Croton—Population 400. There is a grist mill here.

Centerburg—Population 900. The industries of this village are: a handle factory, several tie mills, and lumbering. The village site is high and drainage is good, although there are no sewers. A number of parties have water tanks filled from wells by wind power. The wells are shallow, water being found in sand and gravel below the surface clay.

Brandon—Population 200. Saw mill.

Milfordton—Population 25.

C. WILLS CREEK.

This creek, nearly a river in size, drains a large section of country in which the mining interest is generally of more importance than the agricultural, though the latter regains its advantage where coal is inaccessible. Nearly all of Guernsey and portions of Coshocton, Tuscarawas, Belmont, Monroe, Noble, and Muskingum counties are included in this watershed. Notwithstanding the slight fall of the creek a number of water-powers have been developed of which some are still in use.

Wills Creek—Population 150. It has an abandoned water-power.

Marquand—Population 50.

Otsego—Population 150. Grist mill.

Sago—Population 200.

Bacon—Population 25.

Plainfield—Population 250. There are a grist mill, tile works, and an abandoned water-power, with dam still in, located here.

Linton Mills—Population 100. Water-power grist mill.

Bird's Run—Population 25. Saw mill.

Guernsey—Population 35. There is an abandoned coal mine here.

Flat Ridge—Population 20.

Indian Camp—Population 10.

Kimbolton—Population 250. The industries are a water-power grist mill, a saw mill, steam grist mill, and coal mines. An abandoned salt well is situated one mile east of the village.

North Salem—Population 100.

Tyner—Population 10.

Salt Fork. Populations on watershed of—

Sugartree—Population 50.

Odell—Population 20. A saw mill and coal mine are located here.

Milnersville—Population 300. There are a grist mill and an old creamery here.

Peoli—Population 100. Wagon shop.

Clio—Population 25. There is an abandoned water power here with the dam still in.

Midway—Population 75.

Brady—Population 25. It has an abandoned water power.

Brown—Population 200.

Antrim—Population 300.

Sultan—Population 50.

Middlebourne—Population 150. There is a saw mill here.

Fairview—Population 350. There are a grist mill and a creamery here.

Wills Creek. Populations on watershed of—

Oldham—Population 50. The industries are a stone quarry, a saw mill, and a grist mill.

Creighton—Population 50. Two saw mills.

Galigher—Population 10.

Clayesville—Population 100. There are a saw mill and creamery here.

New Concord—Population 800. The population of this village is increased during a portion of the year by the 130 students of Muskingum college, located here. The college buildings are supplied with water closets draining to a cess-pool. The water is supplied from a tank filled from cisterns.

The industries of the village consist of two planing mills, a grist mill, saw mill and creamery. The latter is sewered to Crooked Creek, causing a nuisance during dry weather.

The water supply for the village is from wells both dug and driven into clay and loose sandstone and from twenty to sixty feet deep.

Cambridge—Population 7,000. Cambridge has developed in the last few years from a country town to a manufacturing and commercial city. It is the distributing point for the large surrounding coal fields and in addition has the following industries: large tin plate mill, an iron mill, three planing mills and two flour mills.

A new separate system of sewers is just being put in, which, when completed, will cover the whole town. At present 50 per cent. of the people have access to it and some 300 have the use of it.

The public water supply is from Wills Creek, but it is not used at all for domestic purposes owing to the bad quality. A new supply is now being sought for, however. The private wells are into sandstone rock, which is struck from just below the surface to twenty-five feet down.

Night soil and garbage are disposed of on a dump northeast of the city. Refuse from both the tin mill and sheet iron mill badly pollutes Wills Creek, the former through Leatherwood Creek.

Leatherwood Creek. This creek drains an important coal district and its waters are seriously polluted by the drains from the mines.

Guernsey County Children's Home—This institution has a population of sixty including officers and attendants. It is located east of Cambridge near Leatherwood Creek to which a sewer carrying the waste from the laundry and kitchen is led. No water closets drain to this sewer as unsewered closets are used entirely. The water supply is from private wells.

Danford—Population 500. The population of this village is variable, depending upon the work in the large coal mines located here.

Washington—Population 600. This was once an important village on the old National Road. Its industries consist of a cider press, grist mill, and several small coal banks. The water supply is from private wells, dug through shale into sandstone 18 to 30 feet down.

Campbell's—Population 150. Its industry is coal mining.

Guernsey County Infirmary—This institution has sixty inmates and six officers and attendants. The buildings are provided with water closets which are used by practically everybody, a few use unsewered closets in summer. Drinking water is supplied from a spring and a dug well 26 feet deep. Water for general use is taken from two drilled wells, 62 and 137 feet deep respectively.

Gibson's—Population 40. It has a grist mill.

Salesville—Population 300. There is an old saw mill here.

Quaker City—Population 950. This village has the following industries: a creamery, saw and planing mill, grist mill, and old glass works. There are a few storm sewers draining the streets to Leatherwood Creek.

The water supply is from a few wells drilled into sandstone rock 65 feet down and from a large number of wells dug from 15 to 20 feet deep into gravel. No vaults are allowed to be covered over, but must be cleaned out and the night soil hauled into the country.

Spencer's Station—Population 75.

Bailey's Mills—Population 100. A coal mine and a grist mill are located here.

Barnesville—Population 4,000. This village drains to three watersheds—Wills Creek, Stillwater Creek, and Captina Creek. The latter is not a tributary of the Muskingum River.

It is estimated that there are 3,000 people in the Muskingum watershed and these are about equally divided between Stillwater and Wills Creeks. A few storm sewers, the gas works, canning factory, cotton mill, and laundry drain to the Captina. A creamery drains to Stillwater, and two glass factories, a car shop and saw mills drain to the Leatherwood Creek.

This is the largest town in the watershed not provided with a public water supply and probably the second largest in the state. The water supply is from private wells both dug and drilled through soil and sandstone to a shallow vein of coal 25 to 50 feet down, in or just beneath which the water is found.

Wills Creek. Populations on watershed of—

Byesville—Population 1,000. This is a mining town recently boomed by the erection of a glass works. The only other industries are a few saw and grist mills. The water supply is from private wells dug through the soil into sandstone found at variable depths below.

Dysons—Population 500. Its industries consist of a number of coal mines and a grist mill.

Blue Bell—Population 25.

Rix's Mills—Population 75.

Cumberland—Population 700. This is an important railroad town with the following industries: coal mines, brick and tile works, a planing mill and a grist mill.

Spratt—Population 25.

High Hill—Population 50. Planing mill.

Glenwood—Population 30. Coal mine.

Mt. Zion—Population 20.

Noble County Infirmary—This institution has twenty-seven inmates and four officers and attendants. The kitchen and laundry waste is sewered to a branch of Buffalo Fork, but no water closets are in use, every one using out-door privies. Water is obtained from a well dug 27 feet into shale and sand.

Chaseville—Population 20.

Sarahsville—Population 350. Coal mines and a grist mill are located here.

Buffalo—Population 300. There are coal mines, a saw mill and a grist mill here.

Mt. Ephraim—Population 150. It has a saw mill, and coal banks are located in the vicinity.

Seneca ville—Population 500. Its industries consist of a water-power grist mill, coal mines, a saw mill and stone quarries.

Kennonsburg—Population 75.

Batesville—Population 400. A grist mill is located here.

Temperanceville—Population 200. A saw mill and a grist mill form its industries.

Calais—Population 150. There is a saw mill here.

Ethel—Population 50.

Doherty—Population 10.

Kulm—Population 10.

Burkhardt—Population 20.

Monroefield—Population 30. Some stone quarries and a saw mill are located here.

d WALHONDING CREEK.

This creek is formed by the junction of the Mohican River and the Kokosing River, both large streams draining rich agricultural districts. Killbuck Creek enters the Walhonding a few miles above Coshocton and also drains a large agricultural district. Portions of the following counties are included in this watershed: Richland, Ashland, Medina, Wayne, Morrow, Knox, Holmes, and Coshocton.

Roscoe—Population 600. This is an old canal town supported by a number of industries holding over from that period. These consist of a woolen mill, saw mill, and two grist mills run by water power, and in addition to these a cooper shop and cider press. The water power is supplied by the canal.

Keene—Population 175. This village has a cider press, soap works, and a number of portable saw mills in the immediate vicinity.

Mound—Population 30.

Killbuck Creek—The lower portion of this watershed is extremely hilly, but the upper through the central and northern portions of Wayne county is much more level.

Metham—Population 20.

Spring Mountain—Population 40.

Blissfield—Population 150. Saw mill.

Helmick—Population 25. Grist mill.

Doughty Fork—This, a very small stream, is notable for the large number of water powers located on it which are still in use.

Clarks—Population 200. There are two saw mills and a cider press in this town, a water power grist mill just below and a small water power woolen mill and saw mill two miles above.

Grade—Population 10.

Saltillo—Population 50.

Beck's Mills—Population 25. This village has a saw mill and a water power grist mill.

Water Powers—These are found above Beck's Mills in the following order: A woolen mill, a saw mill, and a flour mill, all run by water power from Doughty Fork.

Berlin—Population 250. There are a number of small tile mills northeast of here and several small coal banks near.

Killbuck Creek—Populations on watershed of—

Layland—Population 60.

Stillwell—Population 10.

Pictoria—Population 150. There are several old oil wells near this village.

Nashville—Population 300. Saw mill and grist mill.

Killbuck—Population 400. The industries of this village consist of a distillery, water power grist mill, a planing mill, and sandstone quarries. The water supply is from private wells driven through sand and gravel into a lower bed of gravel from 16 to 24 feet down.

Welcome—Population 50.

Millersburg—Population 2,026. This village, the county seat of Holmes county, has a number of prosperous industries, namely, a flour mill, three saw and planing mills, tile and brick works, and machine works; there are also several small coal banks in the vicinity. It has a public water supply from a well near Killbuck Creek; this is used by about three-fifths of the total population, the remainder using water from wells dug about 25 feet deep into clay and gravel.

There are three short combined sewers in use with two outlets to Killbuck Creek. These sewers are used by two hundred and seventy people, the remaining portion using unsewered vaults and cess-pools, dug down to the gravel so as to drain better. Some of these are cleaned out

and the contents buried in the creek bottoms, but many are covered over when full and new ones dug. Garbage is dumped in any convenient place.

Holmes County Children's Home—This home has twenty-eight inmates and six officers and attendants. Its water supply is from a spring on a hill back of the buildings and a well dug 30 feet deep into gravel. The buildings have no sewer whatever, waste water being thrown out on the ground and out door vaults used by every one.

Holmes County Infirmary—This institution has fifty-two inmates and seven officers and attendants. The water supply is from a drilled well six inches in diameter and 252 feet deep, striking the sandstone 200 feet down. The water is pumped to an elevated tank and piped to all the buildings. Practically every one, fifty-five at least, use sewered closets, the remainder using an out-door vault. The waste from the laundry, kitchen, bath, and the water closets above is carried direct to Killbuck Creek. The infirmary farm is well supplied with stock, large numbers of cattle, hogs, and sheep being raised each year.

Benton—Population 200. Cider press and grist mill.

Paint Valley—Population 25. Water power grist mill and cider press.

Holmesville—Population 400. This village ships a great deal of lumber and grain collected from the surrounding country.

Fredericksburg—Population 700. The industries of this village consist of a water power woolen mill, a grist mill, saw mills, creamery, and several small coal banks. A slaughter house above town on Salt Creek sends refuse to the same and causes considerable nuisance. The water supply is from private wells which are both dug and drilled, the former 20 to 40 feet deep in soil and gravel and the latter 80 to 100 feet deep nearly always entering the shale and limestone.

There are a few tile drains to the creek for storm water only. As usual, vaults are constructed in any and every way and never cleaned out.

Kochs—Population 100. Tile mill, grist mill.

Shreve—Population 1,115. The industries of this village consist of saw mills, flour mills, and considerable stock shipping. The town has a public water supply from a dug well which is used by nearly half the people. The remainder obtain water from private wells which are both dug and drilled from 15 to 50 feet into the rock just below the surface.

There is a short storm water sewer to the creek and also a private sewer from a hotel with water closets connected with the same, to which some 20 people have access. Thus practically all the town is dependent upon out-door vaults.

Special—Population 50.

Moorland—Population 60. Saw mill.

Wooster—Population 5,956. In this city, the county seat of Wayne county, Wooster College is located, which influences the character of the town to a considerable extent. It has a number of industries, however, namely, a brewery, distillery, two planing mills, two foundries,

a machine shop, brush works, grist mill, brick yard, canning factory, and pickling works. A little coal is mined in the vicinity and some oil is found to the west.

Wooster has a public water supply from wells, an impounding reservoir, and from Apple Creek, but owing to the objectionable character of the water, especially from the two last named sources, it is not in general use. The private supply is from a few deep drilled wells and from a large number of dug wells only 18 to 25 feet deep; all the water is found in shale which approaches very near to the surface here.

Wooster has practically the combined system of sewers though it could be easily changed to the separate system as not a great deal of storm water is carried in the sanitary sewers. About 65 per cent. of the people have access to these sewers and nearly 2,000 are using the same. The remaining portion depend upon out-door vaults constructed in the usual way. Garbage and night soil are disposed of by hauling to the country and dumping in any convenient spot.

Ohio Experiment Station—Here there are some twenty people engaged in the experimental work of the station. The buildings are supplied with water from a deep well and they are sewered to cess-pools which have no outlet except by seepage.

Wayne County Infirmary—This institution has ninety-five inmates and twelve officers and attendants. Water is supplied from a well 120 feet deep, pumped to a covered reservoir and piped through all the buildings. Water closets are provided for the officers, female inmates, and sick the year round and for all in winter. It is estimated that on an average about seventy use these closets. The sewer from the buildings, carrying all liquid waste, empties into a small branch of Apple Creek. Near this same branch all the slaughtering is also done.

Apple Creek—Population 450. The industries of this village consist of a flour mill and bending works. The water supply is from shallow dug wells and from springs, of which there are quite a number in this vicinity.

Wayne County Children's Home—This home has fifty-two inmates and twelve officers and attendants. Its water supply is from a spring for domestic use, and from a well, for general use. The buildings are provided with water closets which are used at night and in the winter while at other times dry earth closets are used. It is estimated that on an average thirty people use the sewered closets. The sewer, carrying the liquid waste of the buildings, runs to a cess-pool which overflows to Christmas Run. This cess-pool has not been cleaned for three years and now offers but little chance for sedimentation; the sewage passes through with no visible change in its character. It must be noted that Christmas Run is impounded less than one mile below for the water supply of Wooster.

Madisonburg—Population 100. Saw mill, cider press factory.

Plain—Population 60.

Cedar Valley—Population 30.

Congress—Population 200.

Burbank—Population 350. An old water power is located here, the dam is still intact.

Friendsville—Population 75.

Le Roy—Population 100. Wood-working shop.

Creston—Population 600. The industries of this village consist of a pickle factory, hoop factory, and a grist mill. The water supply is from private wells which are both dug and drilled, the former being only 10 to 15 feet deep in the surface soil and clay and the latter going through a stratum of blue clay into gravel which occurs above the rock and 90 to 125 feet down. Vaults are usually covered over when full and new ones dug.

Jackson—Population 25.

Canaan—Population 150.

Golden Corners—Population 35.

Waldhonding Creek—Populations on watershed of—

Warsaw—Population 500. The industries of this place consist of a brick and tile works, flour mill, planing mill, and a creamery. The latter is situated across the river near the railroad station. The water supply is from springs and private wells, the latter usually driven 25 to 30 feet into a bed of gravel just below the surface soil.

Shannon—Population 30. This small village contains a water power grist mill, saw mill, and cider press, all under one roof.

Mohawk Village—Population 50.

West Bedford—Population 100.

New Guilford—Population 75.

New Castle—Population 250.

Walhonding—Population 200. Grist mill.

Tiverton—Population 60.

Kokosing River—This stream, generally known as Owl Creek, drains nearly all of Knox and portions of Ashland, Richland, and Morrow counties. Nearly the whole watershed is level farming land, the eastern portion only being hilly.

Zuck—Population 40.

Millwood—Population 200. Saw mill and water power grist mill.

Howard—Population 200.

Danville—Population 300. There are a number of small cheese factories in this vicinity.

Buckeye—Population 250. Creamery and cider press.

Jelloway—Population 130.

Pipesville—Population 20.

Monroe Mills—Population 60. Saw mill, small cider press, and water power grist mill.

Democracy—Population 150. Cider press.

North Liberty—Population 125. Saw mill and cider press.

Gambier—Population 750. This village is supported entirely by Kenyon College which is located here. The college with two affiliated educational institutions has about three hundred students, and the figure for the population must be increased by a portion of these, the exact number is difficult to determine.

The water supply is entirely from private wells and cisterns, the former very deep, usually entering the sandstone. The college buildings are supplied with water closets sewered to cess-pools; the roof water is caught in tanks for this use.

The industries consist of a saw mill and a water-power grist mill.

Hunt—Population 50.

Mt. Vernon—Population 6,825. Mt. Vernon, the county seat of Knox county, has a public water supply, sewers, and a number of important industries, among which are: a bridge works, engine works, car shops, two steam flour mills and a water-power flour mill, and a planing mill, there are also several brick yards in the vicinity.

The water supply is from wells, and is in general use. A few families are still provided with water from shallow dug wells.

The combined system of sewers is in use with outlets direct to the Kokosing River. Only the central portion of the town is sewered, and, it is estimated that one thousand three hundred and fifty use the sewers. Vaults, in portions of the town, are very objectionable owing to the nearness of the ground water to the surface, and these localities should be sewered as soon as possible.

Knox County Infirmary—This institution has sixty inmates and five officers and attendants. Water is supplied for general use from a three inch drilled well 125 feet deep, for domestic use from a dug well 16 feet deep.

The buildings are provided with water closets which are used on an average by thirty-five people. Waste water is carried by a sewer to Dry Creek, which runs just in front of the infirmary.

Bangs—Population 75. Saw mill.

Mt. Liberty—Population 200. Saw mill and grain elevator.

Bloomfield—Population 60.

Lucerne—Population 30.

Chesterville—Population 274. Grist mill.

Sparta—Population 250. Grist mill and saw mill.

Pulaski—Population 60.

Andrews—Population 100.

Fredericktown—Population 850. The industries of this place consist of a planing mill, saw mill and a water-power grist mill. The water supply is from dug wells which enter a stratum of sand just above the rock 20 to 40 feet down.

Levering—Population 75.

Woodview—Population 120. Small cheese factory.

Ankenytown—Population 75. Grain elevator.

Bangorville—Population 30.

Mohican River—This stream, made up of Jerome Fork, Clear Fork, Rocky Fork, and Black Fork, drains practically all of Richland and Ashland counties and a small portion of Knox, Holmes, Morrow, Wayne, Coshocton, and Medina counties. The northern and western portions of the watershed are level, while the southeastern part is quite hilly.

Wintergreen—Population 25.

Brink Haven—Population 400. The industries of this village consist of a combination grist, saw, and cider mill, and a large water-power flour mill.

Greersville—Population 100. Grain elevator.

Dino—Population 10. Cider press.

Jerome Fork—Populations on watershed of—

Lakeville—Population 100. This is a rather popular summer resort on account of the attractions of Mohican John's Lake. Its one industry is an old grist mill.

McZena—Population 50. There is an old water power cider mill and saw mill just north of this village.

Mohicanville—Population 140. Two small furniture factories and a water power grist mill.

Lake Fork—Population 150. Its industries consist of two saw mills and a large tile mill in the valley above.

Muddy Fork—This is a branch of Jerome Fork.

Reedsburg—Population 125.

New Pittsburgh—Population 100.

Lattasburg—Population 100.

Rows—Population 250.

Red Haw—Population 100. There is a saw mill one and one-half miles north.

Polk—Population 275.

Pleasant Home—Population 100. For ten days in August there is a large camp meeting held here, during which time, it is claimed, there are from six hundred to seven hundred people on the grounds. These grounds are supplied with well water and a number of large vaults for the use of the camp-meeters.

West Salem—Population 700. This is a large country village, with but few industries outside of the commercial line. These are a saw mill and grist mill. The town has no sewers and is supplied with water from private wells.

Perrysburg—Population 75.

Jerome Fork. Populations on watershed of—

Jeromesville—Population 350. This village is the terminus of a small branch of the Pennsylvania railroad. Its industries consist of a saw mill and a water power grist mill.

Hayesville—Population 350.

Ashland County Infirmary—This infirmary has thirty-four inmates and nine officers and attendants. The water supply is from wells. The buildings are provided with sewerred water-closets which are used by about twenty people, the remainder using out door vaults. The waste water is sewerred to a dry run leading to Jerome Fork.

Ashland—Population 4,160. This village, the county seat of Ashland county, has a good public water supply but no sewer system. The industries consist of a pump works, bed spring works, saw mill, and flour mills. There are a few short sewers in for storm drainage only, but several water-closets have been connected, and it is now estimated that fifty-five people use the same. The public water supply is in use by a little more than half the people, the remaining portion being supplied from private wells. These wells are from 13 to 60 feet deep, the shallow ones obtaining water from a bed of gravel just beneath the surface, the deeper ones from a bed of limestone.

Orange—Population 200.

Nankin—Population 20. Saw mill and grain elevator.

Clear Fork—Populations on watershed of—

Davis—Population 100. Saw mill, flour mill and cheese factory.

Hastings—Population 20. There is an abandoned water power just below the village.

Newville—Population 150.

Butler—Population 275. The industries of this village consist of a saw mill, a water power grist and saw mill just below town, and a water power grist mill just above.

Bellville—Population 1,000. The industries consist of a water power grist, planing mill, machine shop, stave mill, and brick yard. There are two short sewers in, for street and yard drainage, which empty into Clear Fork, to which also all surface drainage does. The water supply is from private wells which are usually driven from 20 to 40 feet deep into sand and gravel; a few of the old dug wells are still in use.

Stavemills—This section of the country is full of saw and stave mills working up the few remaining timber patches.

Darlington—Population 40. Saw mill.

Shaucks—Population 200. Saw mill.

Lexington—Population 400. Grist mill and grain elevator.

Steam Corners—Population 100. Saw mill and tile works.

Corsica—Population 100. Saw mill.

Black Fork—There is some question as to which is the main stream, Rocky or Black Fork; most of the maps and the inhabitants themselves give Rocky Fork as a tributary of Black Fork.

Loudonville—Population 1,500. The industries of this village consist of a water power grist mill, a steam grist mill, furniture factory, creamery, machine shop, and saw and planing mills. There are no sewers in, all drainage is through ditches and gutters to Black Fork. The

water supply is from private wells both dug and driven from 18 to 60 feet into sand and gravel.

McKay—Population 30.

Perrysville—Population 567. This is one of the smaller villages which has secured a public water supply; in this case it is in general use very few still using private wells. The village has no sewers and no water closets are in use so far as known.

Rocky Fork—Populations on watershed of—

Lucas—Population 316.

Barnes—Population 35.

Mansfield—Population 20,000. This city, the county seat of Richland county, is the fourth in size in the watershed. It is a manufacturing city, numbering among its products: pumps, stoves, harrows, brick, tile, buggies, beer, wood pulp, ice, gas, etc. It has a public water supply which is used by a little more than half the people. Large numbers still use water from private wells which are dug from 30 to 50 feet into sand and gravel.

Mansfield has the combined system of sewers which, with a large number of private sewers, are used by about 3,500 people. This sewage is emptied into Rocky Fork causing a nuisance of the rankest kind nearly the year round. This nuisance is increased by the manufacturing refuse and by the drainage from the city dump located just east of the corporation right on the banks of the creek. Plans have been presented to the State Board of Health and approved for the disposal of the sewage and garbage and this nuisance may be abated in the near future.

Mansfield State Reformatory—This institution, located just north-east of Mansfield, has three hundred and forty-eight inmates and sixty officers and attendants. Its water supply is from springs located a short distance back of the buildings. These are piped to a reservoir and pumped from there through the Reformatory.

The sewers carry all the waste from the institution and lead it to a large flush tank which discharges it onto intermittent filtration beds. The effluent from these beds runs direct to Rocky Fork and causes no nuisance of any kind.

Alta—Population 30.

Spring Mills—Population 50. There is an abandoned water power located here.

Black Fork. Populations on watershed of—

Mifflin—Population 250.

Pavonia—Population 50. Saw mill.

Richland County Infirmary—This infirmary has a population of one hundred and twenty including officers and attendants. The water supply is obtained from a spring and from cisterns. The buildings are supplied with water closets which are used on an average by sixty peo-

ple. The waste from these together with that from the laundry, kitchen, and bath house is sent direct to a branch of Black Fork.

Paradise Hill—Population 25.

Olivesburg—Population 150. This village has a small flour mill and some stone is quarried here.

Lafayette—Population 100. Saw mill.

Shenandoah—Population 80.

Rome—Population 150.

Ganges—Population 150.

Shiloh—Population 650. This is a quiet country village with no industries.

London—Population 15.

Shelby—Population 3,500. This is a growing manufacturing town, having at present a large steel tube works, bicycle factory, incandescent globe works, umbrella rib works, furniture factory, and nail works. It has a good public water supply which is in use by nearly the whole village. Many still use water, for drinking purposes, from wells sunk ten to twenty feet in gravel. This large use of private well water is due to the fact that the city water tastes of iron.

A new sewer system was just being put in at the time of the inspection which, when completed, will reach about thirty-five per cent. of the people. No connections have been made to these sewers and no water closets, barring a few to cess-pools, are in use, everyone using the outdoor vault.

Night soil is disposed of by hauling to two farms. Garbage is dumped in any convenient spot.

Vernon Junction—Population 60.

Toledo Junction—Population 25.

Cookton—Population 50.

Ontario—Population 150. Under this name are included two or three scattered villages located so close together that the boundary lines are hard to locate.

e. TUSCARAWAS RIVER.

This subsidiary watershed, the largest of the five, includes parts of the following counties: Medina, Summit, Portage, Wayne, Stark, Columbiana, Holmes, Tuscarawas, Carroll, Coshocton, Harrison, Guernsey, and Belmont. In general the northern and western parts are devoted almost entirely to agriculture while in the central, southern, and eastern parts the coal industry is large.

Canal Lewisville.—Population 300. This is an old canal town which has had little life since the decline of navigation.

Coshocton County Infirmary.—This institution has sixty-two inmates and six officers and attendants. Its water is obtained from a drilled well 93 feet deep and is pumped to a reservoir by wind power. The buildings are provided with sewered closets which are used by about fifty people, the remainder using outdoor vaults. The waste from the closets, laundry,

and kitchen is carried to an open ditch leading to a small branch of the Tuscarawas River.

West Lafayette—Population 500. The industries of this village consist of a flour mill, saw and planing mills, and stock and grain shipping.

White Eyes Creek. Populations on watershed of—

Avondale—Population 200. Saw and planing mill, cider press, and water power grist mill.

Pearl—Population 40. Saw mill, stone quarry.

Chili—Population 50. This village is the shipping point for a great deal of lumber and stone.

New Bedford—Population 400. Wagon works.

Evans Creek. Populations on watershed of—

Evansburg—Population 100.

Bakersville—Population 300. The industries of this village consist of a wagon works, flour mill, cheese factory, and novelty works.

Tuscarawas River. Populations on watershed of—

Isleta—Population 50.

Newcomerstown—Population 1,800. The industries of this place consist of a pipe foundry, brick yard, two planing mills, flour mill, machine shop, and water power flour mill. There are two storm water sewers in town draining to Buck Horn Creek, the surface drainage is to this same creek and to the canal. The ordinary vault is in general use and as usual it is never cleaned out but new ones are dug when the old ones fill up.

The water supply is from private wells 24 to 30 feet into a layer of gravel which underlies the whole village. This is the second largest town in the watershed not provided with a public supply, but the question is being agitated and one may be put in.

Garbage is fed to hogs, some of which are kept in the town.

Wolf—Population 50.

Post Boy—Population 50. Abandoned coal mine, and a saw mill.

Albany—Population 30.

Gilmore—Population 150. There are a number of small creameries in the vicinity of this village.

Port Washington—Population 400. This village has a water power grist mill, a planing mill, and several abandoned elevators along the canal.

Seventeen—Population 50. Water power grist mill, and abandoned grist mill.

Gnadenhutten—Population 500. Industries consist of a cider press, canning factory and flour mill.

Tuscarawas—Population 350. This is another old canal town. Its industries now consist of a cider press, saw mill and several small coal mines.

Wainwright—Population 150. Coal mines.

Stillwater Creek—This creek separates a few miles from its mouth into Little and Big Stillwater Creeks. At the junction of these two streams are located the twin cities of Uhrichsville and Dennison, the drainage from which enters both creeks.

Dennison—Population 5,000. This is a division point for the Pennsylvania railroad and here are located quite extensive shops for its general repair work. The other industries consist of a steel plant, brick yard, and coal mines.

Dennison has the combined system of sewers with outlets to Little Stillwater Creek. The sewers give some 40 per cent. of the people access to them and it is estimated that they are used by twelve hundred people. A private water company supplies water from Big Stillwater Creek, which is but little used for domestic purposes on account of the mud. A mechanical filter is being installed which should remove this objection and give the patrons of the company an excellent supply. The same company supplies Uhrichsville with water. The private water supply for both villages is from dug wells from 20 to 50 feet deep.

Uhrichsville—Population 5,200. The industries consist of three large sewer pipe works, wall plaster works, brick yards, coal mines, and the usual flour and planing mills.

The sewers are of both the separate and combined system with outlets to both Big and Little Stillwater. It is estimated that seventy per cent. of the people have access to the sewers, but only four hundred and fifty use them. The water supply is the same as that of Dennison. (See above.)

Little Stillwater Creek. Populations on watershed of—

Station Fifteen—Population 60.

Tappan—Population 40.

Laceyville—Population 20. Saw mill, cider press.

Archer—Population 75.

Enfield—Population 50. Saw mill.

Harrison County Infirmary—This institution has fifty inmates and four officers and attendants. The water supply is from two springs impounded in a reservoir on a hill above the buildings. Some of the buildings have water closets, but the out-door vaults have sewer connections and are flushed regularly, so that all use sewered closets. All liquid waste is carried to Standing Stone Fork through a fifteen-inch sewer.

Folk—Population 30.

Big Stillwater Creek. Populations on watershed of—

Newport—Population 200. Coal mines.

Rush—Population 10.

Stillwater—Population 100. Coal mines.

Rock—Population 25.

Deersville—Population 400. This village has the following industries: several wagon shops, saw mill, flour mill, and a few small creameries.

Hattonia—Population 10.

Cassville—Population 30.

Tippecanoe—Population 250. Water power grist mill.

Cadwallader—Population 100. There are several small creameries near this village.

Smyrna—Population 125. Every summer there is held at this village a very popular fair which draws large crowds from the surrounding country.

Londonderry—Population 100.

Skullfork—Population 50.

Bond—Population 25.

Freeport—Population 700. The industries consist of a flour mill, coal mines, and a grindstone quarry and dressing works. Surface drainage is direct to Big Stillwater through gutters and ditches, there being no sewers in. The water supply is from private wells which obtain their supply at a variable depth in the drift.

Moorefield—Population 200. Two wagon shops and saw mill.

Holloway—Population 10.

Kennon—Population 50.

Piedmont—Population 275. This is the smallest village in the watershed which has a public water supply. Here several springs are impounded on a hill and the water supplied by gravity to the village below. The water is used by about fifty per cent. of the people, the remaining portion obtain their water from private wells sunk from 15 to 30 feet in the drift. Three houses containing fifteen people are furnished with water closets which are sewerred direct to the creek.

Compher—Population 20.

Sevelsville—Population 100. Grist mill.

Egypt—Population 10.

Morristown—Population 400. Wagon shop, saw mill, and grist mill.

Hendrysburg—Population 300. Grist mill and cigar factory.

Olivett—Population 30.

Barnesville—Population 4,000. This village was reviewed in the Wills Creek watershed, but it is again mentioned as the drainage from a portion of it, together with the refuse from a creamery, goes to a branch of Big Stillwater.

Tuscarawas River.

Midvale—Population 400. This is a new town brought into existence by the coal mines and large sewer pipe works located here.

Barnhill—Population 1,000. This village is supported by a large coal mine and a large fire clay works. It has no sewers, and the surface drainage is to the Tuscarawas River through a small run. The water supply is from private wells dug through soil, quick sand, and soft rock into a bed of gravel 25 to 45 feet down.

Goshen—Population 100. Coal mines.

Beidler—Population 150. Coal mines.

Tuscarawas County Infirmary—This institution has one hundred and one inmates and nine officers and attendants. About fifty people have use of sewered closets and the remainder use outdoor vaults. These closets, together with the kitchen and laundry are sewered to Beaver Dam Creek and to one of its branches.

The water supply is from a 90-foot well which is pumped to elevated tanks in the attic. At times a spring back of the buildings is piped in for use.

Blackband—Population 40.

Blakes Mills—Population 350. This village, a suburb of New Philadelphia, has two industries: a brewery and a water power grist mill.

New Philadelphia—Population 6,231. This city, the county seat of Tuscarawas county, has a number of modern improvements, including a public water supply, sewers, paved streets, and two electric car lines. Its industries consist of a steel mill, brick and tile works, gas works, saw and planing mills, flour mill, cheese factories, etc., also a water power electric light plant.

The public water supply is from wells and it is used by a little more than fifty per cent of the people. The private wells furnish the rest of the people with water, they are usually driven 50 or 60 feet into the drift.

New Philadelphia has both the combined and separate system of sewers, these empty into the Tuscarawas River and Beaver Dam Creek. It is estimated that thirty per cent. of the people have access to the sewers and that they are used by 1,020. Night soil, dead animals and garbage are carried to the country or buried in any convenient spot.

Stone Creek—Population 250. Brick and tile works.

Tuscarawas County Children's Home—This home has seventy-four children and ten officers and attendants. It is supplied with water from the Canal Dover public supply. About fifty of the inmates use sewered closets, the remainder still use the out-door vault. The waste from these closets, together with that from the laundry and kitchen, is sent direct to the Tuscarawas River, on whose banks the home is located.

Canal Dover—Population 5,212. This is a manufacturing town with the following industries: a tin plate mill, iron works, blast furnace, brewery, buggy factory, two brick yards, baby carriage factory, two water power flour mills, and several coal mines. At one time there was a salt works here, but it has been abandoned.

The town has no sewers now, but a system will probably be shortly introduced as plans have been prepared. Most of the drainage, however, from the manufacturing establishments, is sent direct to the river.

Canal Dover has an excellent public water supply from wells; this water is in use by about one-third of the people; the remainder use water from private wells which are from 30 to 50 feet deep, in sand and gravel all the way. This water cannot help but be of poor quality because, as stated, there are no sewers, and vaults are never cleaned, new ones being

dug when the old ones are filled up.

Sugar Creek—This stream enters the Tuscarawas River at Canal Dover and drains a large section of agricultural land.

Winfield—Population 100.

Strasburg—Population 225. The industries of this village consist of a tile works, water power saw mill, and a planing mill.

Dundee—Population 150. Water power grist mill.

Trail—Population 75. Grist mill, tile and brick yard, coal mines in the vicinity.

Walnut Creek—Population 100. This is an "Omish" village with the following industries: distillery, saw mill and seven cheese factories in the immediate vicinity.

Barrs Mills—Population 50. Saw mill, cheese factory, water power grist mill, and cider press.

Shanesville—Population 500. The industries consist of a turning factory, foundry, saw mill, grist mill, small tannery, cheese factory and coal mine.

The water supply is from wells dug 18 to 40 feet into limestone, coal and shale. An abandoned oil well 490 feet deep furnishes a mineral water which is used for medicinal purposes in a bath house.

Sugar Creek—Population 250. This village is the railroad station for Shanesville above and is rapidly growing. It now has a flour mill, planing mill, saw mill, tile works, and creamery, the latter, however, does not run much now.

Farmerstown—Population 40.

Baltic—Population 450. This village has a grist mill and creamery. There are portable saw mills at work in this section.

Beach City—Population 350. The industries consist of a canning factory, cigar factory, saw mill, grist mill, and machine shop.

Justus—Population 200. Coal mines.

Wilmot—Population 500. This village has a woolen mill, creamery, grist mill, planing mill, and brick yard all draining direct to a branch of Sugar Creek.

Mt. Eaton—Population 280. There is a separator for the Wilmot creamery just north of here and several small coal banks in the vicinity.

Winesburg—Population 275. Cheese factory and cider press.

Elton—Population 100. This is a mining town.

West Lebanon—Population 150.

McQuaid—Population 10.

East Union—Population 20.

Weilersville—Population 40. There is located here a large milk depot where the cream is separated and shipped to a Pittsburgh creamery.

Smithville—Population 480. The industries of this village consist of a planing mill, cider press, grist mill, saw mill, and pickle works.

One Leg Creek—The watershed of this creek is a rich coal mining district.

Zoar Station—Population 150.

Valley Junction—Population 50.

Mineral Point—Population 1,200. Coal mining and the manufacture of brick and tile constitute the industries of this village. A public water supply was put in in 1899. The water is from springs and is now in use by nearly half of the people. There are no sewers whatever in use, all surface water being carried to Huff's Run through gutters and ditches. As surface privies are used to a large extent the storm water run off contains much objectionable matter.

Somerdale—Population 300. Coal mines.

New Cumberland—Population 170. Here are located a small creamery and a grist mill.

Indian Fork. Populations on watershed of—

Atwood—Population 15. Old creamery.

Dellroy—Population 500. This is a mining town with the following industries in addition: a saw mill, grist mill, creamery, and cider press.

Tabor—Population 25. Coal bank.

Carrollton—Population 1,500. This village, the county seat of Carroll county, has a public water supply, a few short sewers, and a few small industries, namely: a brick yard, saw mill, planing mill, and flour mill. Its public water supply is from wells and the water is used by nearly every one. There are two short combined sewers leading to Honey Run which carry the waste from water closets, to which eighty people have access.

One Leg Creek. Populations on watershed of—

Leavittsville—Population 40.

Sherodsville—Population 900. This is an old mining town, still supported by the neighboring mines, its railroad interests and a small water power grist mill. The water supply is from shallow dug wells which cannot help but furnish a poor water, as the privies are not water-tight and are never cleaned out.

Palermo—Population 10.

Algonquin—Population 50. This village has a few small coal mines, a saw mill, and a grist mill.

Leesville—Population 400.

New Hagerstown—Population 200.

Bowerston—Population 550. This village is affected to some extent by the oil boom at Scio. Its other interests consist of a grist mill, several saw mills, and a number of coal mines.

Conotten—Population 150. This is quite a large shipping station.

Lamartine—Population 150. Near this village are located a cider press, several small coal banks, and a number of portable saw mills.

Kilgore—Population 250. Two cider presses.

Scio—Population 1,800. The recent oil boom has changed this place from a pretty country village to a large dirty town. Its industries consist

of its oil wells, oil well supply houses, saw mills, and a flour mill. A public water works was put in for fire protection in 1899. The water is obtained from wells and is an excellent supply, but it is not used for domestic purposes to any extent as yet. The private supply is from shallow wells both dug and driven into a bed of quick sand found just below the surface soil and clay.

There are no sewers in town, all drainage is through open gutters and ditches to Conotten Creek. As there are but few vaults in use this surface water is very filthy. Many privies are built directly over the creek and much garbage, waste oil, etc., is emptied into it, all of which keep it in a very filthy condition.

New Rumley—Population 175. Saw mill.

Germano—Population 275. Flour mill.

Jewett—Population 600. This village was supported almost entirely by a large car works which has since been moved to Newark taking many people with it. Its industries now consist of a flour mill and several saw mills. It is also in the oil district.

Fife—Population 30.

Tuscarawas River. Populations on watershed of—

Zoar—Population 300. This village is the headquarters for the old communist society of Zoar. The property of the society has but recently been divided and the society broken up, in a way. The industries consist of a water power flour and saw mill, and a cider press.

Bolivar—Population 700. The industries of this village consist of a planing mill, saw mill, grist mill, cider press, cheese factory, poultry yard, and fruit drying establishment. Its surface drainage is to the canal which also gets considerable refuse during its passage through the village.

Sandy Creek—This stream with its principal tributary, the Nimi-shillen Creek, drains a thickly populated section of the Muskingum watershed.

Sandyville—Population 250. Water power grist mill.

Nimishillen Creek. Populations on watershed of—

Sparta—Population 200. This little village supports a brick yard, planing mill, and a water power grist mill.

Howenstine—Population 70. Water power grist mill.

North Industry—Population 200. The industries of this village consist of brick and tile works and several coal banks.

Waco—Population 25.

Osnaburg—Population 650. In and near this place are located a cider press, feed mill, planing mill, tile works, and several small cheese factories.

Canton—Population 40,000. This, the county seat of Stark county, is the largest city in the watershed. Its most important industries consist of a large watch factory, a large watch case factory, a rolling mill, bridge works, steel plant, steel ceiling works, several machine works,

two brick and tile works, a phosphate works, soap works, gas plant, ice plant, and brewery.

The public water supply is obtained from wells and the West Branch of the Nimishillen Creek. It is used by a little more than half of the people. The private supply is almost entirely from driven wells which enter a bed of sand and gravel found from 20 to 30 feet below the surface soil and clay.

Canton has the separate system of sewers. It is estimated that fifty per cent. of the population has access to these sewers and that they are used by eight thousand people. The sewage collected in this system is carried below town to a chemical precipitation works, where the suspended matter and a portion of the dissolved impurities are removed and the effluent turned into the Nimishillen Creek. The storm water sewers empty into both the East and West Branch of Nimishillen and into Shrivvers Run. These sewers together with a number of private sewers carry off all the manufacturing wastes and the sewage of a number of houses which were connected before the sanitary system was put in. The watch and watch case factories employ about two thousand hands, the sewage from which is sent directly to the West Branch. The combined sources of pollution cause the creek to become objectionable during low stages of water. Garbage is disposed of individually by burning and by hauling to the country.

Stark County Infirmary—This institution has two hundred and fifty inmates and fifteen officers and attendants. The water supply is from a drilled well 225 feet deep and eight inches in diameter. The water is lifted by a small steam pump to an elevated tank and piped from there through all the buildings. The buildings are provided with water closets which are used by about one hundred people. The others use out-door vaults, which are built and cemented and cleaned out when full. The sewer from the institution, carrying all the liquid waste, is emptied into a cess-pool, the overflow from which is to a gravel swale leading to the West Branch of Nimishillen Creek. From an inspection it was impossible to determine if any of this sewage reached the creek, but it is probable that it does during heavy rains.

Marchand—Population 50.

Aultman—Population 100. Here are located a grain elevator and several large celery farms.

New Berlin—Population 700. This is an old village, occupied by retired farmers. Its industries consist of a harness factory and a pole and shaft works.

Cairo—Population 30.

Greentown—Population 500. The one industry of this village is a large brick and tile works. Much refuse from this plant, and, it is claimed, some sewage from the same, enters the West Branch of Nimishillen Creek.

Oval—Population 50. Water power grist mill.

Middlebranch—Population 250. This village and many of the neighboring ones are supported by a large Portland cement works located here.

Fairhope—Population 25.

Louisville—Population 1,628. This village has a public water supply, but no sewers whatever. Its industries consist of two tile works, two flour mills, a stove factory, two blower works, a pump works, planing mill, and several small cheese factories near. The public water supply is from wells and is used by a little more than half of the people. The private wells are usually dug through soil and shale into gravel from 20 to 40 feet below.

Barryville—Population 200. Saw mill.

Sandy Creek. Populations on watershed of—

Magnolia—Population 500. The industries consist of a small creamery, a water power grist mill, a woolen mill, brick works, and several coal mines.

Waynesburg—Population 500. This village has one of the oldest public water supplies in the state. In 1857 a couple of springs above town were impounded and the water piped through the village. This water is now used by about one-third of the people. The industries consist of a brick and tile works, saw mill, cider press, and a few small coal mines. The village has no sewers.

Mapleton—Population 100. Two cigar factories.

Robertsville—Population 200. There are a few small cheese factories near this village.

Paris—Population 250. This place has a grist mill and a small cheese factory.

Freeburg—Population 75. There are small cheese factories in the vicinity.

Malvern—Population 700. The industries of this village consist of two large fire and paving brick plants, a sewer pipe works, furniture factory, planing mill, cooper shop, water power grist mill, and old creamery.

Hibbets—Population 15.

Carroll County Infirmary—This place has 40 inmates, five officers and attendants. The water supply is obtained from a well 130 feet deep, it is pumped to a reservoir and piped through the buildings. A sewer carries the waste from the kitchen and laundry to a small run leading to Sandy Creek. There are no sewered closets, all must use out-door vaults. Two of these vaults may be flushed to a sewer by rain water, but the number using these however is uncertain.

Oneida—Population 150. There is located here an old water power grist mill which is now being fixed up for operation.

Augusta—Population 200. Saw mill and flour mill.

Pattersonville—Population 25.

Specht—Population 25.

Eckley—Population 40.

Mechanicstown—Population 200. Flour mill.

Minerva—Population 1,250. This village has a public water supply and a few short sewers. Its industries consist of a tile works, two flour mills, a creamery, canning factory, and cider press. The public water supply is from wells and is in use by nearly the whole village. There is a short sewer for surface drainage only, leading to the creek. A few houses have water closets, but these drain to cess-pools.

New Franklin—Population 100.

Bayard—Population 75.

Moultrie—Population 50. Stone quarry.

Greenhill—Population 20.

East Rochester—Population 200. Creamery.

New Chambersburg—Population 60. This village has two saw mills and a few coal banks.

New Alexander—Population 100. Here are located a flour mill and a small woolen mill.

Tuscarawas River. Populations on watershed of—

Navarre—Population 1,170. This village obtained its growth during the height of the canal season and it has gained but little, if any, since that time. Its industries now consist of a glass marble works, pottery, wood working shop, grist mill, and an old soda ash plant which runs occasionally.

The water supply is from private wells which are dug from 15 to 60 feet into a bed of sand and gravel underlying the whole town site. There are no sewers in use, out-door vaults being used entirely. These are never cleaned, and from the nature of the soil must pollute the ground water seriously.

Richville—Population 100. Saw mill.

Pigeon Run—Population 75. Coal banks.

Rhoads—Population 15.

Massillon State Hospital—This hospital for the insane is located just south of Massillon and contains some four hundred inmates, and one hundred officers and attendants. The number of inmates is rapidly increasing as new cottages are now being completed. Everything about the institution is in first-class condition, in fact it is a model asylum. The water supply is from three drilled wells, each six inches in diameter, and 375 feet deep. These wells strike the sandstone at a depth of 225 feet and are thus 150 feet in the rock. The wells are pumped by an air lift from these wells to a cistern, then to a standpipe, and distributed from there to the buildings. The buildings are provided with complete modern improvements of the latest type. All waste water is collected by a complete sewer system and carried to intermittent filtration beds for disposal. The effluent from these beds enters a run which leads to the Tuscarawas River.

Massillon—Population 15,000. This is a manufacturing town with many important industries, among which are a stove foundry, pipe foundry, engine and thresher works, rolling mill, bridge works, glass factory,

brick and tile works, stone quarries, pottery, strawboard works, saw mills, etc. Much of the refuse from these works is sent direct to the river and a great deal goes to the canal from which place it finally reaches the stream through the numerous overflows.

Massillon has a good public water supply, in fact two supplies, one from wells for domestic use, and one from an impounding reservoir for manufacturing purposes. The domestic supply is used by nearly one-half of the total population. The private water supply is from drilled wells which obtain their water from a bed of sand and gravel found just above the rock which is 20 to 30 feet down.

Massillon has the combined system of sewers with one outlet to the river and several storm overflows to the canal. The sewers are not extensive and are used by about 1,200 people. Nearly every house in the city has an out-door vault, very few of which are water-tight. The night soil is hauled to the country. Garbage is dumped along the canal and river banks below town.

West Brookfield—Population 200. This is a suburb of Massillon.

Beach Grove—Population 125. Coal mines.

Sippo—Population 50. Coal mines.

East Greenville—Population 500. There are four or five large coal mines in and near this village.

Crystal Springs—Population 175. There is a brewery here, the refuse is sent direct to the canal.

Newman—Population 100. Coal mines.

North Lawrence—Population 900. This is a typical mining town supported by several large coal mines. There is also a creamery just north of this place.

McDonaldville—Population 100.

Canal Fulton—Population 1,200. The industries of this town consist of an agricultural implement works, a flour mill, two tool works, three saw and planing mills, a creamery, and several coal mines. The water supply is from private wells, these are usually dug from 15 to 18 feet into a large bed of sand and gravel. All drainage is through gutters and ditches to the canal and river. Much refuse is also dumped into the canal.

Nimisila—Population 150.

Comet—Population 25.

Warwick—Population 15.

Chippewa Creek—This creek drains the southern part of Medina county and the northeastern part of Wayne. Much of this area is quite flat, making it necessary to put in large ditches for good drainage.

Marshallsville—Population 400. Carriage factory.

Easton—Population 200. This village has a saw mill, flour mill and a small creamery.

Doylestown—Population 950. This is an overgrown country village with but one manufacturing establishment—an agricultural imple-

ment works. The private wells are from 14 to 75 feet deep and obtain their water from the gravel above the bed rock, several enter the sandstone a few feet. As there are no sewers in town and vaults are never cleaned, the subsoil must be seriously polluted.

Weaver Hill—Population 25.

Rittman—Population 200. The industries of this village consist of a salt works, tile mill, and grain elevator. The salt works obtains its product from rock salt which is found 2,600 feet below the surface. All drainage from this section is more or less impregnated with the waste of this plant.

Wadsworth—Population 2,000. The industries of this place consist of a match factory, injector works, saw mill, and salt works. The salt is obtained from the same strata as the one struck at Rittman. The village has a public water supply from springs and wells. This water is used for domestic purposes by nearly two-thirds of the people. The private wells are dug from 40 to 60 feet deep through the drift, a few reaching the Berea sandstone below. There are a few short combined sewers in, of which about fifty people have the use. Vaults are constructed as usual and but few cleaned out.

Silver Lake—Population 40.

Western Star—Population 100.

Acme—Population 25.

River Styx—Population 100. Creamery.

Orrville—Population 2,000. The railroad interests are large here; other industries consist of a grist mill, machine shop, planing mill, and creamery. The public water supply is from wells and it is used by three-fourths of the people. A few still use the water from private wells dug from 12 to 20 feet through the drift into the bed rock below. The village has no sewers whatever, all drainage is north through ditches and gutters to the Orrville ditch. Vaults are constructed in any manner, but they must be cleaned and the contents hauled out on the farms.

Barton—Population 200. Feed mill.

Dalton—Population 750. This village has a public water supply from a well located on a hill west of it. The water is but little used for domestic purposes, everyone still having private wells. These wells vary from 20 to 100 feet deep, but all enter the rock. Vaults are but seldom cleaned out, and if so, the contents are buried in any convenient spot. There are two short sewers for storm drainage only.

Sterling—Population 300. Here are located a grain elevator and an old glass works.

Seville—Population 600. This is a very pretty country village. Its industries consist of a saw mill, flour mill, and a few small machine shops.

Blake—Population 50. Saw mill.

Chippewa Lake—Population 200. This village is a summer resort and the headquarters for a large summer population around Chippewa Lake.

Whittlesey—Population 100.

Medina County Infirmary—This institution has eighty-three inmates and seven officers and attendants. The water supply is from cisterns and from a well 51 feet deep. The buildings are supplied with water closets which are used by every one. The sewer from the institution runs north to a branch of Chippewa Ditch, which turns south into Chippewa Lake.

Tuscarawas River. Populations on watershed of—

Clinton—Population 400. This is an old canal town with no industries now except a saw mill and flour mill.

Hametown—Population 100. Coal mine.

Sherman—Population 100. Coal mine.

Barberton—Population 4,000. This town has been in existence for but a comparatively short time. Its growth has been due to the large manufacturing establishments located here, among which are a large sewer pipe works, boiler works, match factory, paint works, strawboard works, and rubber factory. A soda ash plant is in the course of construction. There is a public water supply in, which is, however, not used for domestic purposes. Private wells supply all the water for this use; these are driven at variable depths into the drift formation and seem to furnish a good supply.

Barberton has the separate system of sewers with one outlet to Wolf Creek for the sanitary sewers. The surface drainage is to the above creek, the canal, and the Tuscarawas River. There are but few indoor water closets in use, but nearly all the houses have the out-door standpipe closet all of which are connected to the sewers. It is estimated that 3,000 people use these sewers. Very few vaults are used and these must be cleaned out and the contents hauled to the country. The large amount of sewage causes a nuisance during times of low water in the creek.

Wolf Creek—Populations on watershed of—

Johnson—Population 200.

Norton—Population 50.

Copley—Population 200. Creamery.

Loyal Oak—Population 150. Saw mill.

Sharon Center—Population 200.

Boneta—Population 20.

Smith Road—Population 30. Saw mill.

Troy—Population 30.

Windfall—Population 50.

Tuscarawas River. Populations on watershed of—

New Portage—Population 200. This is practically part of Barberton.

Waterloo—Population 10.

Swartz's Corners—Population 15.

Krumroy—Population 20.

Summit—Population 125.

TABLE IV.—SEWERAGE OF CITIES AND VILLAGES HAVING PUBLIC WATER SUPPLIES

Number	Name of Town	Estimated Population for 1900	Kind or Status of Sewers, in Use	Method of Disposal of Sewage	Outlet of Sewers	Number of Outlets	Number of Miles of Sewers	Percent of Population to be Served by Sanitary Sewers	Number of Outlets or Connections to Sewers	Estimated Pounds of Sewage Disposed of Daily	Percent of Total Population Using Sewers	Does the Sewage Cause a Nuisance?	Factories, Sawmills, etc., which are a source of pollution, or which discharge refuse into the streams	Disposal in Miles to Sewer Water	Remarks and Notes	
1	Ashland	4,160	Combined	Dilution	Jerome Fork of the Mohican river	4	1.4	30	55	330	8	In summer	Zanesville	85	Nuisance caused principally by industrial wastes	
2	Barberton	4,000	Separate	Dilution	Wolf creek	1	9.7	80	470	3,000	75	During low water	Zanesville	134	Sewers carry considerable storm water. Only 90 water tanks, most of the connections are standpipes grooved fluted with roof water.	
3	Canal Dover	5,212	None										Zanesville	76	Sanitary sewers underway	
4	Canton	10,000	Separate	Chemical Precipitation and Dilution	Effluent disposal works to Nimishillen creek. West Branch Nimishillen creek, 0.1 mile storm sewer. East Branch Nimishillen creek, 2.1 miles storm sewer. Shriver's run, 2.5 miles storm sewer. Watch Factory sewer to West Branch Nimishillen creek.	1 4 4 1	Sanitary, Storm, Storm,	19.0 10.6	50	1,394	10,000	35	Effluent at times Shriver's run in summer and fall. Watch Factory during low water.	Zanesville	106	Sewage of 2,000 Watch Factory employees goes down to West Branch Nimishillen creek. Some closet connections to old storm sewer going to West Branch Nimishillen creek.
5	Cambridge	7,000	Separate	Dilution	Willis creek	1	4.3	50	50	300	4	At times	Zanesville	63	A new system. Data approximate.	
6	Carrollton	1,500	Combined	Dilution	Honey run	2	4.4	10	12	85	8	During low water	Zanesville	106		
7	Coshocton	3,000	Separate	Dilution	Tuscarawas river—storm sanitary	2 1	Sanitary, Storm,	6.5 1.0	65	250	1,500	80	Very slight at times	Zanesville	29	
8	Danville	750	Storm	Dilution	Branch of Beaver Dam	2	0.1					No	Zanesville	143		
9	Deshon	5,000	Combined	Dilution	Little Stillwater creek	6	4.0	40	175	1,200	34	Decided during low water.	Zanesville	69	Number of connections approximate.	
10	Granville	1,800	None										Parkersburg, W. Va.	113	Dennon College has separate sewer system with disposal system. Filtration. Surface drainage to Racoon creek.	
11	Louisville	1,638	None										Zanesville	116	Surface drainage to branch of Nimishillen creek.	
12	Manfield	20,000	Combined	Dilution	Rocky Fork of Mohican river, 1.9 miles. Rotor's run, 0.8 miles	2 1	9.7	30	500	3,500	18	Decided at all times	Zanesville	83	Number of connections approximate. Disposal system planned.	
13	Massillon	15,000	Combined	Dilution	Interceptor to Tuscarawas river. Storm overflows to canal	1	6.8	30	200	1,200	8	During low water	Zanesville	103		
14	Marietta	12,500	Sanitary	Dilution	Ohio river	3	10.1	75	800	4,000	38	In extreme low water	Parkersburg, W. Va.	12	Number of connections approximate.	
15	McCordsville	1,500	Combined	Dilution	Mackinong river	2	0.7	30	10	60	2	No	Parkersburg, W. Va.	105		
16	Millersburg	2,025	Combined	Dilution	Killbuck creek	2	1.3	40	45	270	13	Very seldom	Zanesville	58		
17	Minerva	1,250	Storm	Dilution	the Sandy creek	1	5					No	Zanesville	113		
18	Mr. Vernon	6,835	Combined	Dilution	Kokosing river	5	6.0	25	235	1,350	30	During low water	Zanesville	68		
19	Mineral Point	1,200	None										Zanesville	86	Surface drainage to branch of One Leg creek.	
20	Newark	20,384	Combined	Dilution	Racoon creek, 1.0 mile. South Fork Licking creek, 0.4 mile. North Fork Licking creek, 2.6 mile	4 2 2	9.0	40	500	5,000	14	During low water	Parkersburg, W. Va.	105		
21	N. Philadelphia	6,231	Combined and separate	Dilution	Beaver creek, 0.7 mile storm sewer. Little Stillwater, 0.1 mile sanitary. Tuscarawas river, 0.3 mile storm sewer. Tuscarawas river, 1.7 mile combined sewer. Tuscarawas river, 0.5 mile sanitary sewer	1 1 1 1	Storm, Sanitary, Combined,	1.2 0.9 1.7	30	170	1,020	10	No	Zanesville	72	
22	Orwell	2,000	None										Zanesville	135	Surface drainage to Rocky Fork of the Mohican.	
23	Perrysville	567	None										Zanesville	78	Surface drainage to Rocky Fork of the Mohican.	
24	Piedmont	275	Combined	Dilution	Big Stillwater creek	1	0.1	10	3	15	5	No	Uhrichsville and Denison	23		
25	Scioto	1,800	None										Zanesville	106	Very foul surface drainage to One Leg creek. An oil town.	
26	Shreve	1,115	Sanitary and Drainage	Dilution	Branch of Killbuck creek, 0.1 mile sanitary	1	0.2		2	30	2	No	Zanesville	72	Due private sewer fronted into 2 cellar drain down main street.	
27	Shelby	5,300	Sanitary	Dilution	Black Fork of the Mohican river	1	3.6	35					Zanesville	111	Disposal system planned and under way.	
28	Uhrichsville	1,200	Separate and Combined	Dilution	Big Stillwater, 0.5 mile storm water. Little Stillwater, 0.1 mile sanitary. Little Stillwater, 0.3 mile sanitary. Little Stillwater, 0.4 mile combined sewer	2 1 1 1	Storm, Sanitary, Combined,	1.0 1.0 0.4	70	75	450	9	Decided every summer and fall	Zanesville	69	
29	Wadsworth	2,000	Combined	Dilution	Branch of River Styx	3	0.5	10	6	30	2	Slight at times	Zanesville	128		
30	Waynesburg	990	None										Zanesville	103	Surface drainage to Big Sandy creek.	
31	Wooster	5,056	Combined	Dilution	Apple creek. Tuscarawas river	2 1	6.6	65	320	1,020	6	During low water	Zanesville	78	System easily separated into sanitary and storm. Number of connections approximate.	
32	Zanesville	24,405	Combined	Dilution	Chapin run. Licking creek. One Leg creek. Little Stillwater. Mackinong river	1 1 1 1 8	4.9	80	777	5,000	20	No	Parkersburg, W. Va.	80		
Totals and Averages		Total, 210,885 Sewer'd map, 190,182 Not Sewer'd, 14,707	Combined, 3 Separate, 6 Storm only, 2 Mixed, 3 None, 3	One purification plant Remainder Dilution		1	Combined, Sanitary, 53 Storm, 61 Total, Combined and Sanitary, 113 Average per sewer'd town, 1.8 Average for all, 3.3	53 61 113 1.8 3.3	Average for sewer'd towns, 19 Average for all, 36 Average per sewer'd town, 1.8 Average for all, 3.3	Total, 9,038 Average for sewer'd towns, 274 Average for all, 121	Total, 39,063 Average for sewer'd towns, 1,170 Average for all, 121	Average for sewer'd towns, 1,170 Average for all, 121		Percent of total population having access to sewers, 30 Percent of total population in sewer'd towns having access to sewers, 12 Percent of total population using sewers, 15 Percent of population accessible to sewers using same, 20 Percent of population accessible to sewers using same, 17		

Summer Resorts—In and near the canal reservoirs are many hotels and boarding houses for summer visitors, also, during the season, the country is full of camping parties. The sanitary arrangements for the accommodation of these people are of the crudest sort and much filth finds its way to the lakes and streams.

Milheim—Population 30. In this village there is a cider press and just above a water power grist mill.

Myersville—Population 60. Saw mill.

Inland—Population 400. This village is supported by the large tile works at Greentown.

2. SEWERAGE OF CITIES AND VILLAGES HAVING PUBLIC WATER SUPPLIES.

Under this heading there has been brought together brief descriptions of the character and extent of the sewerage of those towns in which public water supplies have been introduced. For convenience of reference and for a better opportunity for comparison, these facts were put in tabular form.

This table, together with the maps and the following notes give, it is believed, all the information necessary for a complete understanding of the kind and amount of pollution the streams receive from the various towns and also the amount that may be expected in the near future.

Barberton—There is to be noted in reference to this town, the large number of people using the sewers. This was caused by the fact that Barberton is a new city, built up by its industries, so that long rows of houses were put up by men interested in the development of the city. These men fortunately recognized the value of a sanitary city and put in sewers first of all, to which they connected all the houses. As before stated there are but few inside water closets, but nearly every house has the common stand-pipe closet, so called, which is flushed by rain water and by hand where required. If the city increases in population at its present rate for a few more years a disposal system will be necessary or a new outlet at least, as the present one causes a nuisance in times of low water in Wolf Creek.

Canal Dover—A sanitary sewer system has just been designed for this village, and it is expected to be put in during the coming year. It is badly needed, as there are a number of new buildings going up in which it is desired to put all modern conveniences. The lack of regulations regarding the construction and cleaning of vaults has caused the subsoil to become saturated with filth, a condition which can be greatly remedied by a good sewer system, especially if the public are compelled to put in connections and to abandon their out-door vaults.

Canton—This city has a good system of sewers, the only fault that can be found is that they are not extensive enough and that every one is not compelled to use them. Before the sanitary sewers were put in there were a few old combined sewers in use, many of which are now used for storm water. These old sewers still have a number of closet connections

to them which it has been almost impossible to shut off. The sewage of the two thousand employes of two large factories also escapes the sanitary sewers and is emptied direct to the West Branch of Nimishillen Creek. Much manufacturing refuse is sent direct to an open ditch or sewer, Schriver's Run, which flows through the heart of the town, causing a nuisance the whole summer long. The sanitary sewers all enter one outfall sewer which leads to a disposal plant just south of town. Here the sewage is treated by the chemical precipitation process as described in the last annual report of the State Board of Health. The average amount treated has been 1,700,000 gallons per day, of which the city engineer estimated that thirty per cent. is seepage water. As in the past, much of the sludge has been pumped out on the fields to be disposed of by filtration and to be used as a fertilizer, the remainder has been pressed and the sludge cake removed by farmers. The total cost to date, March 20th, 1899, of the disposal plant was \$31,545.10. The operating expenses for the year were \$3,275.01; this does not include the interest. The effluent has in general been satisfactory and no complaint has been made.

Mansfield—This city has a piece-meal system of combined sewers, augmented by many private sewers, to which the sewage of about three thousand five hundred people is sent. The Rocky Fork, into which the sewage is discharged, is much too small for its work and a horrible nuisance results from this abuse. Suits have been brought against the city for maintaining this nuisance and have been won. The near future will probably see some disposal system installed.

Ulrichsville and Dennison—The sewage of these two places enters the Big and Little Stillwater Creeks and causes a nuisance through all the dry months. At times Little Stillwater is simply vile, and if the amount of sewage is to increase, some other method of disposal should be found if not at present.

At the bottom of the above table will be found a list of totals and averages some of which bring out interesting facts. Of the 210,889 people living in towns having public water supplies 196,182, or ninety-three per cent., live in towns which have more or less sewerage. The seven per cent. without any sewers represent eight towns or twenty-five per cent. of the total number. Two of these villages, however, have storm water sewers only, no closet connections having been made as yet.

All dispose of the sewage by dilution, except one, Canton, which has a chemical precipitation plant for the treatment of the sewage from its sanitary sewers.

From the columns giving the outlets of the sewers and their number it is seen that the nearest creek or river has been used and that but few have so unified their systems that the sewage could easily be collected for purification when it becomes necessary as it is even now in numerous cases. The next column, however, shows that there are nearly

as many miles of sanitary sewers as there are combined, but that the former systems are fewer in number. The construction of sanitary sewers has been favored for their cheapness and for the fear of the necessity of purification, a fact which does not, however, seem to have been considered when the outlets of many of the sewers were determined. This also brings out the fact that where competent engineers have been employed, sanitary sewers have been put in and the outlet question considered, while on the other hand, where skilled assistance has not been secured, no provision has been made for the future.

The average figures show 4.8 miles of sanitary or combined sewers for sewered towns to which 38 per cent. of the people of each town have access, or for all the towns only 3.3 miles of the same classes of sewers to which only 26 per cent. of the people have access.

Passing from the next column showing the number of connections to the one showing the number of people using the sewers, it is found to be lamentably small. Of a total of 210,889 people living in towns provided with public water supplies only 39,065 or 18.5 per cent. are using the sewers; 39 per cent. of the total population are accessible to the sewers and only 18.5 per cent. of the total population, or 47 per cent. of those accessible to the sewers, use the same. Considering only those towns which have some sewers the figures become 42 per cent. for those having access and 20 per cent. for those using the same. The two or three fairly well sewered towns have brought up the figures considerably, as can be seen by comparing with the averages for each town considered separately.

The sewage from all the towns except Shreve, Piedmont, Minerva, and Dalton, which have practically none, and that from Zanesville, New Philadelphia, and McConnelsville, which discharges into a large stream of water, causes more or less of a nuisance at times. Some of these give trouble only when the streams are exceptionally low, and others are offensive nearly all the time. The results of the pollution of public water supplies will be taken up later on.

3. SEWERAGE OF ISOLATED PUBLIC INSTITUTIONS.

As in the former case much of the information regarding this subject has been tabulated, though not so completely, however. In connection with the sewerage two columns have been added in reference to the water supply.

TABLE V — WATER SUPPLY AND SEWERAGE

Number.	Institution.	Location.	Population, Including Of- ficers, Servants, Attend- ants, Etc.	Water
				For Drinking Pur- poses.
	MISCELLANEOUS.			
1	Denison College.....	Granville	380	Granville Public Supply
2	Mansfield Reformatory...	Just N. E. of Mansfield	408	Springs impounded
3	Massillon State Hospital.	Just South of Massillon	500	3 Wells, 375 feet deep
4	Ohio Experiment Station.	Just South of Wooster.	20	Well, 150 ft. deep
	COUNTY INFIRMARIES.			
1	Ashland	5 miles S. E. of Ashland	33	Well
2	Carroll	3 miles North of Car- rollton	45	Well, 130 ft. deep
3	Coshocton	2½ miles East of Co- shocton	68	Well, 93 ft. deep.
4	Guernsey	9 miles East of Cam- bridge	66	Well, 26 ft. deep, and spring
5	Harrison	2 miles West of Cadiz.	54	Springs impounded
6	Holmes	3 miles North of Mil- lersburg	60	Well, 252 ft. deep.
7	Knox	4 miles S. W. of Mt. Vernon	65	Well, 16 ft. deep.

OF ISOLATED PUBLIC INSTITUTIONS.

Supply.		Sewerage.		Remarks and Notes.
For General Use.	Estimated Number of Persons Using Sewered Closets.	Estimated Number of Persons Using Unsewered Closets.	Method and Place of Disposal of Sewage.	
Same	200	180	Filtration through soil.. Effluent to Raccoon Creek	6 Private houses on this system. Many use closets in daytime only.
Same	408	.....	Intermittent Filtration... Effluent to Rocky Fork..	
Same	500	.....	Intermittent Filtration... Effluent to Tuscarawas River	
Same	15	5	Run to Cesspool..... Surface drainage to Apple Creek	
Same	20	13	Dilution	All use sewered closets in winter.
Same .....	.....	45	Bath, Laundry and Kitchen waste goes to Run leading to Myres Creek	At times closets may be flushed to sewers.
Same	50	18	Emptied out on fields which drain to Morgan Run	
2 Wells, 62 and 137 ft. deep....	60	6	Dilution	
Same	54	.....	Run, leading to Leatherwood Creek	
Same	55	5	Dilution	
Well, 125 ft. deep.	35	5	Killbuck Creek	
			Dilution	All use sewered closets in winter.
			Dry Creek	

TABLE V—WATER SUPPLY AND SEWERAGE

Number.	Institution.	Location.	Population, Including Officers, Servants, Attendants, Etc.	Water
				For Drinking Purposes.
8	Licking	6 miles S.W. of Newark	81	Wells, 30 ft. deep.
9	Medina	2 miles S. W. of Medina	90	Rain-water and some well-water
10	Morgan	3 miles South of McConnelsville.....	60	Spring
11	Muskingum	1 mile N. W. of Zanesville	137	Well, 70 ft. deep..
12	Noble	7 miles North of Caldwell	31	Well, 27 ft. deep..
13	Richland	5 miles N. E. of Mansfield	120	Spring
14	Stark	1 mile North of Canton	265	Well, 225 ft. deep.
15	Tuscarawas	1½ miles S. E. of New Philadelphia	110	Well, 90 ft. deep, and Spring
16	Wayne	2 miles S.E. of Wooster	107	Well, 120 ft. deep.
CHILDREN'S HOMES.				
1	Guernsey	Just East of Cambridge	60	Well
2	Holmes	2 miles N. W. of Millersburg	35	Well and Spring..
3	Licking	Just East of Newark...	98	Newark Public Supply
4	Morgan	½ mile North of Malta.	43	Well, 20 ft. deep.

OF ISOLATED PUBLIC INSTITUTIONS — Continued.

Supply.	Sewerage.			Remarks and Notes.
	Estimated Number of Persons Using Sewered Closets.	Estimated Number of Persons Using Unsewered Closets.	Method and Place of Disposal of Sewage.	
For General Use.				
Spring	50	31	Dilution Remp Creek	Nearly all use sewered closets in winter.
Well	90	.....	Dilution Chippewa Ditch	
Same .....	.....	60	Surface drainage to Muskingum River	
Zanesville Public Supply	137	.....	Dilution Licking Creek	
Rain Water.....	.....	31	Bath, Laundry and Kitchen waste goes to Buffalo Creek	
Spring and Rain Water	60	60	Dilution Ravine leading to Black Fork	
Same	100	165	Run to Cesspool which overflows to gravel swale leading to West Branch Nimishillen Creek	
Same	50	60	Dilution Runs leading to Beaver Dam	
Same	70	37	Dilution Run leading to Apple Creek	All use sewered closets in winter.
Same .....	.....	60	Bath, Laundry and Kitchen waste goes to Leatherwood Creek....	
Same .....	.....	35	Surface drainage to Killbuck Creek	
Same	98	.....	Dilution Licking Creek	
Dug Well.....	20	23	Dilution Muskingum River	

TABLE V—WATER SUPPLY AND SEWERAGE

Number.	Institution.	Location.	Population, Including Officers, Servants, Attendants, Etc.	Water
				For Drinking Purposes.
5	Tuscarawas	Between Canal Dover and New Philadelphia	84	Canal Dover Public Supply
6	Washington	1 mile North of Marietta	60	Well, 45 ft. deep..
7	Wayne.....	Just North of Wooster.	64	Spring
27	Totals .....	.....	3,144	.....
	Averages .....	.....	116.4	.....

OF ISOLATED PUBLIC BUILDINGS—Concluded.

Supply.	Sewerage.			Remarks and Notes.
For General Use.	Estimated Number of Persons Using Sewered Closets.	Estimated Number of Persons Using Uns'w'r'd Closets.	Method and Place of Disposal of Sewage.	
Same	50	34	Dilution Tuscarawas River	All use sewered closets in winter.
Rain and Well Water .....	.....	60	Waste from Bath, Kitchen and Laundry goes to Muskingum River	
Well	30	34	Run to cesspool which overflows to Christmas Run	All use sewered closets at night and in winter.
.....	2,152	992	.....
.....	79.7	36.7	.....

The importance of including these public institutions may be readily seen when the number of people using sewered closets is taken into consideration. In many cases one of these places with two or three hundred inmates sends more sewage to the streams than do most villages with a population of as many thousands.

Three of these institutions have purification plants for their sewage and two use cess-pools which prevent the serious pollution of the streams.

Denison College—As shown in the table this institution, together with its affiliated school and a number of private houses includes about three hundred and eighty people, of whom it is estimated two hundred use sewered closets. All the sewage is conducted by one trunk sewer to a filtration bed 2,000 feet away and situated in the bottom land of Racoon Creek. The bed has an area of one acre and was prepared by scraping off the surface soil and underdraining with four-inch tile placed twenty feet apart. The bed is composed of a sandy loam and seems well adapted for its work. The sewage is led to various parts of the bed by shallow ditches and allowed to seep away until the surface clogs slightly, then it is run to a new spot. The underdrains lead to a six-inch drain which empties into the creek a short distance below. This drain never contains any water except during and after rain-storms. Storm water is kept off the bed by means of embankments formed from the soil which it was necessary to remove from the surface. No attempt has been made, to crop the bed and no objectionable odors were noticed.

Mansfield Reformatory—This institution has a total population of four hundred and eight, all of whom use sewered closets. All the liquid waste of the Reformatory is led through a fifteen-inch main sewer to a gate chamber from which it goes to two screen chambers and then to a two thousand gallon flush tank. The screen chambers are in duplicate so that one may be cut out for cleaning. All chambers are provided with by-passes for use in case of accident. Sludge pipes also lead from all, by means of which the accumulated sediment may be drawn off onto some low ground and allowed to filter away. From the flush tank the sewage is automatically sent to the beds situated on the low land near Rocky Fork just west of the main building. There are four beds in all with a total area of a little over one acre. They are composed of crushed sandstone from a neighboring quarry, four and one-half feet thick. The surface is trenched or corrugated, into which depressions the sewage flows. The beds compact easily and the sewage stands on the surface for some little time before disappearing. The underdrains are four and one-half feet below the bottoms of the trenches and from fifteen to thirty feet apart. During one season it was attempted to raise corn, but it was unsatisfactory and has not been tried since. The beds were put in during the fall of 1896 and have been giving satisfaction. The effluent goes to Rocky Fork and is of good quality as far as appearance goes.

Massillon State Hospital—This institution has a population of five hundred, but this is constantly being added to. The buildings are modern in every way and are provided with every convenience as regards water and sewerage. All the sewage flows into a ten-inch main which leads to a settling tank holding eighteen thousand gallons, from which it is discharged, every eight to ten hours, automatically onto the disposal beds below. This settling tank is constructed of brick and is completely covered over so that the sewage to a certain extent undergoes a septic action. A water main is run to this basin so that from time to time it may be flushed out. The sewage is discharged intermittently from the tank upon four one-quarter acre beds. These contain four and one-half feet of sand and gravel; each is underdrained with three lines of tile. The embankments around and between the beds are constructed of the earth removed from the surface. The sewage is distributed from the outfall sewer to the various beds through pipes laid in the embankment, and from these it is spread over the beds through wooden gutters. Along the outfall sewer there are places arranged from which the sewage can be diverted for use for broad irrigation on the lawn and fields adjoining. The effluent from the beds goes to a small branch of the Tuscarawas River and is clear and odorless, and they appear to be doing good work. It has been attempted to raise pumpkins, peas, corn, and squash on the beds, but with no great success as yet, though it has not been abandoned.

None of the infirmaries nor children's homes have sewage disposal plants, though they are needed in several cases for the sake of avoiding a nuisance. The large amount of land available and the complete control of the sewage makes it very easy to install a disposal system, and the sewage of these institutions should not cause a nuisance. In nearly every case, also, there is plenty of labor at hand for the work.

4. SUMMARY.

In summarizing the contents of the three previous sections, the most attention will be given to the effect of the pollution of the watershed upon the public water supplies now in existence and upon new ones which may be put in.

As will be shown in the report upon the public water supplies of this watershed there are but four towns supplied wholly with surface water from this watershed and only four which are supplied in part with this water. Only two of these public supplies, the one for Zanesville and the one for Uhrichsville and Dennison, are polluted with sewage from a city or village, and the supply for the last two towns by such a small amount that it need hardly be considered. The supply for Canton may receive indirectly the sewage from the Stark county infirmary, and that for Wooster the sewage from the Wayne county children's home. The supplies for Cambridge, Newark, and Massillon receive water polluted

only by farm and rural drainage, and by industrial wastes. Massillon uses its surface water supply for industrial purposes only and so does not enter this question. The surface supply of Newark from the North Fork of Licking Creek is polluted by the drainage from a well-farmed district on which are located many small villages, one only of which, Utica, can be classed as urban. The run-off from this watershed is not of the purest, but it can no doubt be considered as potable. As this water is used only in its best condition in order to supplement the ground supply, it has caused no complaint and its use is not greatly objectionable.

Cambridge, on the other hand, receives a water likewise free from sewage pollution, but coming from a mining district where the rural population is of the poorer class, it is much filthier. In addition the water receives the drainage from a large number of coal mines, and the character of the soil is such that the stream is always very turbid. The water from Wills Creek cannot be considered as potable.

Canton is partially supplied with water from the West branch of Nimishillen Creek. The watershed of this stream, above the intake, contains a rather dense rural population, the majority of which is engaged in agriculture, but quite a number are employed in the brick and tile works at Greentown. From this plant with its large number of men, much filth is washed into a small run leading to the creek. Just above Canton the county infirmary sends the sewage of about one hundred people to a cess-pool which overflows to a gravel swale leading to the creek. During dry weather none of this reaches the creek, but during a heavy rain it is very probable that some of it may be washed into the same.

Part of the supply of Wooster is drawn from an impounding reservoir on Christmas Run, a very small stream draining a few square miles of land. Besides the farm drainage, the sewage from the Wayne county children's home enters this stream and renders it unfit for domestic use.

At present the entire supply of Zanesville is taken from the Muskingum River and pumped to the supply reservoirs without any treatment whatever. The river at this point has a watershed of 5,850 square miles, which includes all of the Walhonding, Tuscarawas, and Wills watersheds and the upper part of the Muskingum River basin. Zanesville therefore receives the drainage from twenty-seven cities and villages having public water supplies, of which nineteen have more or less extensive systems of combined or sanitary sewers. Besides the sewage from these cities and villages there are twenty public institutions on this watershed, fifteen of which send sewage to the streams. The cities and villages send the sewage of 26,205 people to the streams, and the institutions that of 1,632, making in all 27,837 people, the sewage from whom reaches the public water supply of Zanesville. This sewage enters the Muskingum River and its tributaries at widely varying distances above Zanesville: the nearest source of pollution is Coshocton twenty-nine miles above, and the most

remote is Wadsworth, one hundred and twenty-eight miles above, both distances being by water.

Table 4 gives the exact amount of the city and village pollution and the distance of the same above Zanesville. The remoteness of most of this sewage and the small amount at each separate place gives the natural forces every opportunity to purify the same, and this fact alone keeps the Zanesville city supply at all usable. To the credit of Zanesville it may be said that a new supply is now being sought for.

Marietta obtains its water supply from the Ohio River above the mouth of the Muskingum River, and thus escapes the influence of the latter stream. The combined sewage of the Muskingum watershed, including that of Marietta, influences the supply of Parkersburg, West Virginia, twelve miles below Marietta.

In general none of the larger streams of the watershed can furnish a potable water. Almost at their headwaters all the branches of the Muskingum River are polluted with sewage, and the few that are not already so polluted have growing villages on them, some of which now have public water supplies and will soon be putting in sewers. Public institutions are also responsible for the pollution of a few of the streams.

These facts may be brought out more clearly by Plate 17 which shows all the towns which have a population of 1,000 or over and all isolated public institutions. As may be seen from the explanation on the map, different symbols are used to designate the towns having public water supplies and sewage, those having water only, those having neither, and also the public institutions sending sewage to the streams and those not so doing. By this means there are located all the important sources of sewage pollution, and also those points where pollution is to be expected in the near future. The shaded bands point out the streams which receive sewage pollution and are not desirable for use as public supplies without purification. As is seen these include the five main streams of the watershed and nearly all the important tributaries.

When the pollution caused by drainage from farms and villages, and from industrial wastes is considered there will be but few streams left, capable of furnishing a good water. The small streams of the Muskingum River, Tuscarawas River, and Wills Creek basins contain so much clay and mine drainage that, if not dangerous for domestic use, they are at least very objectionable. The small streams of the Licking Creek and Walhonding Creek basins do not contain as a rule, so much clay and little, if any, mine drainage, and so have a much better chance to furnish good water. In many cases the potability is destroyed here by the drainage from highly manured fields and from stock-raising districts. As seen from the report of the chemist and bacteriologist the water of the Kokosing River above Mt. Vernon and that of the North Branch of Licking Creek above Newark, is of a very fair quality, especially during the lower stages of the streams. A public water supply impounded from

streams of this character, if protected from the washings of isolated privies, might furnish a potable water if the impounding reservoir were so arranged that the first washings after rains could be diverted and only the purer after-flow caught.

As stated before, several changes have been made in the map of this watershed, due to more detailed information, and a new table showing the relation of the urban populations and the watershed areas has been prepared as follows:

TABLE VI—URBAN POPULATIONS IN RELATION TO WATERSHED AREAS.

Number.	Town.	Estimated population 1899.	Name of stream.	Area of watershed in square miles.	Square miles of watershed per 1,000 population.	Water and sewers.
1	Ashland	4,160	Branch of Jerome Fork...	2	.5	W.-S.
2	Barberton	4,000	Wolf Creek...	75	19.0	W.-S.
3	Barnesville	4,000	Located at headwaters of 3 creeks.....			
4	Barnhill	1,000	Branch of Beaver Dam Creek	2	2.0	.....
5	Belleville	1,000	Clear Fork ...	112	112.	.....
6	Byesville	1,000	Wills Creek...	290	290.	.....
7	Canal Fulton	1,200	Tuscarawas R..	388	320.	.....
8	Canal Dover	5,212	Tuscarawas R..	1,656	318.	W.
9	Canton	40,000	Nimishillen Cr.	149	3.7	W.-S.
10	Cambridge	7,000	Wills Creek ...	458	65.	W.-S.
11	Carrollton	1,500	Honey Creek..	11	7.3	W.-S.
12	Coshocton	5,000	Muskingum R..	4,709	942.	W.-S.
13	Dalton	750	Orrville Ditch.	7	9.3	W.
14	Dennison and Uhrichsville	10,200	Stillwater Cr..	464	45.	W.-S.
15	Dresden	1,400	Muskingum R..	5,779	4,128.	.....
16	Granville	1,800	Raccoon Creek.	71	39.	W.
17	Loudonville	1,500	Black Fork....	344	229.	.....
18	Louisville	1,628	East Branch of Nimishillen Creek	23	14.	W.
19	Mansfield	20,000	Rocky Fork ...	36	1.8	W.-S.
20	Massillon	15,000	Tuscarawas R..	470	31.	W.-S.
21	Marietta	12,500	Ohio River....	26,730	2,138.	W.-S.
22	McConnelsville	2,500	Muskingum R..	6,889	2,756.	W.-S.
23	Millersburg	2,026	Killbuck Creek	383	188.	W.-S.
24	Minerva	1,250	Clear Fork of Sandy Creek.	49	39.	W.
25	Mt. Vernon	6,825	Kokosing River	250	37.	W.-S.
26	Mineral Point	1,200	Huffs River....	7	5.8	W.
27	Navarre	11,700	Tuscarawas R..	500	43.	.....
28	Newark	20,386	Licking Creek.	523	25.	W.-S.
29	New Comerstown	1,800	Tuscarawas R..	2,348	1,304.	.....
30	New Philadelphia	6,231	Tuscarawas R..	1,696	272.	W.-S.
31	Orrville	2,000	Orrville Ditch.	39	20.	W.
32	Perryssville	567	Black Fork....	305	538.	W.
33	Piedmont	275	Big Stillwater Creek	118	429.	W.
34	Roseville	1,000	Branch of Jonathan Creek	80	80.	.....
35	Scio	1,800	Conotton Creek	37	21.	W.
36	Shreve	1,115	Branch of Killbuck Creek..	10	8.9	W.-S.
37	Shelby	3,500	Black Fork....	33	9.4	W.-S.
38	Somerset	1,200	Headwaters of 2 creeks			
39	Wadsworth	2,000	Branch of River Styx	2	1.0	W.-S.
40	Waynesburg	500	Sandy Creek..	224	448.	W.
41	Wooster	5,956	Killbuck Creek.	170	29.	W.-S.
42	Zanesville	24,008	Muskingum R..	6,612	275.	W.-S.

W—Water supply. S—Sewers. Dalton, Perryssville, Piedmont and Waynesburg not urban, but included as they have public water supplies.

This table is patterned after the table given in Allen Hazen's preliminary report on the public water supplies of Ohio, and for the same purpose. It is intended to show at what towns it may be possible to dispose of sewage by dilution, if no public water supply is endangered, without causing a nuisance. From the estimates of Mr. Hazen it requires from fifteen to forty square miles of watershed for each one thousand people using the sewers, in order to obtain water enough in the dry seasons to carry off the sewage without causing a nuisance. The wide limits are necessary on account of the variation in run off of different watersheds and the variation in the ability of the different streams to dispose of sewage. No attention has been paid in the table to the pollution of the water as it reaches each town but it is considered as pure, something which in many cases is far from correct.

From the above supposition it is seen that the following towns will most certainly need some method of disposal other than dilution, as soon as systems of sewers at all extensive are introduced:—Ashland, Barnesville, Barnhill, Canton, Carrollton, Dalton, Louisville, Mansfield, Mineral Point, Shreve, Shelby, Somerset, and Wadsworth.

The truth of this statement is amply borne out by several of these towns; Canton has put in a disposal plant to protect itself; Mansfield, is now working on the design of a disposal system, the need of which has been long recognized; Shelby has a system designed and will install it shortly. Barnhill and Mineral Point are within a short distance of the Tuscarawas River where ample water for dilution could be found. The other towns are near the headwaters of the various streams and will be compelled to dispose of their sewage by some other method than dilution. The need is already being felt in Ashland, Carrollton, and Wadsworth, with only a few connections in each town.

At Dennison and Uhrichsville, Massillon, Newark, and Wooster, with but partially constructed sewer systems a nuisance is caused at times by the sewage, and the watersheds above these towns are well above the minimum allowable figure. The other towns having less than forty square miles of watershed per one thousand of population have but little if any sewage as yet and hence can furnish no data on this subject.

V. ICE SUPPLIES.

In addition to the regular inspection of the watershed, it was attempted this year to take up the question of ice supplies and to report upon the source, pollution, and quantity of ice used by the various towns. It was at once found to be impossible to even estimate the quantity used without an enormous amount of time and labor, much more than the character of this work would allow. Regarding the source and pollution as much information as possible was obtained.

In these later days ice must be divided into natural and artificial. The first kind is the best for cooling purposes on account of its greater porosity and hence more rapid melting; and also as a general rule on account of its cheapness. Artificial ice, on the other hand, is usually purer and thus better for domestic purposes where it is placed with food and used for making ice water.

The Muskingum watershed has several distinct sources from which natural ice may be obtained, namely as follows:—

a.—Flowing streams.

b.—Natural lakes.

c.—Artificial ponds.

d.—The Ohio Canal, together with its supply reservoir and basins.

From the flowing streams but little ice is cut in this watershed except from the back water of the numerous dams. Over most of the watershed there are but few freezes each year which will cause ice to form on flowing water thick enough for profitable cutting. The ice that is cut from the flowing streams, except where they suffer sewage contamination, is, as a general rule, of better quality than that obtained from any of the other sources of natural ice. Of course ice obtained from a sewage polluted stream is not fit for domestic use under any circumstances. In but few cases does the erection of dams in the stream injure the quality of the water, while they form excellent places from which to cut ice. Occasionally the dams impound so much of the stream's flow as to cause the water to stagnate and thus promote the growth of the various water grasses and organisms, though but seldom does this trouble extend into the ice season owing to the washing-out effect of the fall rains.

The ice obtained from the few natural lakes is usually free from serious sewage pollution but it is high in vegetable matter. Lakes are so rare to Ohio that even small ones bring to their borders numerous camping parties and also permanent residents, the cause of the sewage pollution. These lakes are nearly all shallow and bordered with more or less

extensive swamp areas. This, together with the fluctuation of the water level, promotes the growth of weeds and grasses to such an extent as to make the water quite foul. The effect upon the ice of this excess of organic matter is very uncertain. Ice frozen during a period of absolute quiet, in which the lake has an opportunity for sedimentation, would contain a much less quantity of this vegetable matter than ice frozen during a period of high winds and rains. The effect of high winds upon these shallow lakes is very marked; often the course of a few hours will change a comparatively clear water to a muddy ill-smelling one.

Sometimes in the case of the smaller lakes a hard rain will wash enough farm drainage to cause visible pollution.

Artificial ponds furnish a large amount of ice; they are the favorite source of supply for the large number of towns away from the larger streams and the canal system. As a rule these ponds are small and each one furnishes only a small amount of ice, it is the large number of ponds which makes this an important source of supply. The ponds are usually made by damming a small stream, by straightening up the excavations left by old brick yards; in fact any low place capable of being made to hold water is utilized. They are filled by gravity from streams and springs, or by pumping from the above sources and from wells. Those filled by gravity usually contain more or less water the year round while those that are filled by pumping are always dry in summer. The ponds that contain some water in the summer are never cropped but left to grow up in weeds and brush wherever the water is shallow enough; on the contrary, those to which the water has to be pumped, are as a rule cultivated, but in some instances they are left to grow up in weeds. As regards the purity of ice from artificial ponds, it is safer to investigate each source separately. In general, however, the ponds are dirty, poorly protected from surface drainage, overgrown with weeds, and accessible to stock.

The Ohio Canal is supplied with water from the summit lakes and reservoirs at the northern part of the watershed and from the Licking reservoir at the southern end; then in between with surface drainage whenever the canal is low enough, and with the flow of the rivers and creeks, intercepted and brought to the canal by feeders. The water thus consists of an extremely varied quality of surface drainage, some of which is polluted with sewage and all of which is polluted with farm drainage. In addition to the above pollution, wherever the canal passes through a populated district it is made the receptacle of filth of all kinds, garbage, rubbish, and manufacturing wastes. The canal water, it may be safely said, never even approaches potability, and from this water is cut an enormous amount of ice, probably as much as from all the other sources of natural ice together. It is an ideal place from which to cut ice when purity is not considered; the water has little current, hence freezes quickly, and it is comparatively free from sediment, but considering purity,

ice from the canal should not be used for domestic purpose under any circumstances.

The artificial ice in use is made by local ice companies, by local breweries, and by outside firms who ship their products in. As far as learned all the local ice companies use distilled water to make their ice. The water for the boilers is usually obtained from wells on the company's grounds, or from springs, and in a few cases from the public water supply of the town. The usual process is to condense the water in rectangular cans which are lowered into a solution kept cold by ammonia under pressure. As the cans are frozen solid they are hoisted out, the cakes dumped out and stored, and the cans refilled with distilled water to go through the same process. The ice made in some of the breweries is primarily for cooling purposes only and is not necessarily pure, but some of the large establishments make a good quality of ice and sell it for domestic use.

Columbus, Akron, and Wheeling, West Virginia, are the only towns out of the watershed that ship ice in to any extent. Within the watershed—Canton, Mansfield, Massillon, Newark and Zanesville have artificial ice companies. Breweries in these same towns also make ice for their own use, but little for outside distribution.

TOWN SUPPLIES.

Owing to the diversity in the sources of ice supplies any classification must be rough if elaborateness is avoided. In assigning the towns to the divisions as named above, the principal source of their supply determines the class.

FLOWING STREAMS.

Brink Haven—Only a small amount of ice is used and this is cut from a mill race fed from the Mohican River. The local conditions are good but the stream is polluted with sewage at its head waters.

Butler—Large quantities of ice are cut from the Clear Fork of the Mohican and from a mill race fed by the above stream. There is no sewage pollution, the only objectionable feature being the rubbish dumped into the creek.

Crooksville—A small amount of ice is cut from the South Fork of Jonathan Creek.

Gambier—Ice is cut from the back water of the mill dam in the Kokosing River south-east of the village. There is no local pollution but the stream has just received the sewage of Mt. Vernon seven miles above.

Jeromeville—A small amount of ice is cut from the back water of a mill dam in the Jerome Fork of the Mohican River. The water is badly polluted at this point by drainage from a stock yard.

Marietta—This city is supplied almost entirely with ice from the Muskingum and Ohio Rivers. It is of poor quality, muddy, and much of it is polluted locally with sewage.

Malvern—This supply is cut from the back water of a mill dam on Big Sandy Creek.

McConnelsville and Malta—These represent the class of towns on the slack water navigation of the Muskingum River. Most of the ice is supplied from the back water of the government dams where the conditions are favorable for freezing. This ice is of poor quality, muddy, and polluted with sewage. Some is cut from small artificial ponds and a small amount of artificial ice is shipped in.

Minerva—Very little ice is used and this is cut from the Clear Fork of the Sandy Creek, which at this point is in fair condition.

Perrysville—A small amount of ice is cut from the back water of an old dam in the Black Fork of the Mohican. This water is stagnant except during high stages and receives the surface drainage of the village.

Utica—Licking Creek supplies a small amount of ice of good quality.

Warsaw—A small amount is cut from Walhonding Creek.

Zanesville—This city, as might be expected from its size, is supplied with artificial and natural ice, the latter from several sources. Owing to the use of a larger proportion of natural ice cut from streams it was placed in this class. Most of this ice is cut from the back-water of a mill dam at the mouth of Licking Creek. The creek at this point receives the sewage of the County Infirmary, and part of that of Zanesville, and the drainage from a number of slaughter houses. A great deal is also cut from an impounding reservoir on Timber Run. This pond has an area of about seven acres and is contaminated by the drainage from an old dump, a grave yard, and several privies.

The artificial ice is made by the Zanesville Ice Company from water distilled from the city supply. About eight thousand tons are made annually, about half of which is supplied to neighboring towns.

One of the local breweries also makes a small amount of ice for its own use.

NATURAL LAKES.

Barberton, Canton, and Massillon are supplied in part by lake ice but not to such an extent as to bring them within this class. In fact the bulk of the lake supply is shipped out of the watershed.

Mohican John's Lake—This is a pretty little body of water on a tributary of the Mohican River in the south-eastern part of Ashland County. It furnishes an enormous amount of ice of fair quality for the Pennsylvania railroad. The pollution comes from the hotel and camping parties and from a creamery at Big Prairie, which drains to it. The lake is surrounded by an extensive area of swamp land which also adds some objectionable constituents to the water.

Chippewa Lake—This lake, in the southern part of Medina County, is quite an extensive body of water. It is fed by surface drainage and by a few springs, and forms the head-waters of Chippewa Creek. In summer

it is a popular resort and is surrounded by cottages and camping parties. Its most serious pollution is due to this and to the sewage of the Medina County Infirmary which enters a tributary of the lake three miles above. From this lake is cut a small amount of ice for local use and thousands of tons for the use of Cleveland.

ARTIFICIAL PONDS.

Ashland—The supply is entirely natural and is obtained from three small ponds; one of these is located on high ground just south of the village and is filled from a well by pumping; the pond is in grass in summer and kept in fair condition. The other two ponds are one-fourth of a mile north of the village in the low valley of a small stream, the flow of which is diverted to fill them. They are practically dry in the summer and overgrown with weeds and grasses. The surface drainage is rather objectionable and the ice must be of but poor quality.

Barnesville—About one-half of the ice supply is cut from local ponds which are contaminated by objectionable surface drainage; the remainder is shipped in from the Wheeling artificial ice companies.

Creston—A very small amount is cut from the abandoned workings of an old brick yard, the quality is poor.

Dennison and Uhrichsville—These villages are supplied with natural ice from an old bay cut off from Big Stillwater Creek by the C. L. & W. railroad. The pond is full of stagnant water and receives the drainage and refuse from a slaughter house on its banks. Some ice is also cut from the creek itself. Both furnish ice unfit for domestic use.

Loudonville—The whole ice supply is obtained from two small ponds which are dry in summer and overgrown with weeds. During the season they are kept full by springs.

Louisville—This village is supplied from a pond fed by springs and located in the eastern part of town. Some is cut also from a pond by the local brewery.

Mt. Vernon—This city is supplied almost entirely with natural ice from local ponds; a little artificial ice is shipped in from Columbus during poor seasons. The natural ice is put up by one firm from four ponds. One in the western part of town is supplied by a mill race fed by the Kokosing River. The pond is dry in summer and badly overgrown with weeds; it is one acre in area and about fourteen hundred tons are put up from it annually. The three ponds in the eastern part of the city are from one-half to three-fourths of an acre in area, each, and are fed from Center Run. Two of the ponds are dry in summer and overgrown with weeds, the other is kept full of water and used as a duck pond. It is covered with scum in places and the aquatic growth is heavy. All three are polluted by dirty house and barn-yard drainage.

New Concord—The ice is cut from old fish ponds constructed during the time when every farmer tried to have fresh fish the year round. They are filled by surface drainage and are in poor condition.

Roseville—A small amount of ice is cut from local ponds.

Shelby—The only source of ice is from a pond located right in town and polluted by the surface drainage from the streets, dirty yards, and several adjacent privies. The ice must be badly polluted and unfit for domestic consumption, nevertheless from two hundred to four hundred tons are put up each year and nearly always disposed of. The large amount of acid emptied into the creek prevents the obtaining of any ice from that source. During poor seasons for natural ice considerable artificial ice is shipped in from Mansfield.

Shreve—The ice is cut from an artificial pond about one-fourth of an acre in area, located just south of town and fed from an old race which is in turn fed by a large spring and by adjacent surface drainage. The pond is kept in good condition and supplies a fair quality of ice.

Somerset—The largest part of the ice is cut from a shallow pond just east of town and the remainder is artificial and shipped from a Columbus brewery.

Wadsworth—Ice is cut from a pond located in the center of a race track west of town. The pond has an area of about one acre and is fed by surface water; it is never dry but is badly overgrown with weeds. The surface drainage from the track and nearby stables must pollute it seriously. The ice is cut and sold to the private ice houses in winter, none or very little is stored by the pond owner.

Wilmet—At times a small amount of ice is cut from a pond in the southern part of the village.

Wooster—This city is supplied entirely with natural ice by three firms obtaining ice from artificial ponds, located south, north and east of town. The east supply is from two ponds filled from a mill race which is fed by Apple Creek. The ponds have a combined area of two acres and are filled in winter only; in summer they are under cultivation. During favorable seasons three thousand tons are cut and stored here. The water for this ice is taken from Apple Creek above local pollution, and a good quality of ice could be put up if the ponds were carefully protected. A three-fourth acre pond just south of town supplies about eight hundred tons annually. This pond is dry in summer and overgrown with weeds. It is filled by an old race which is fed from Apple Creek after it receives the refuse from the distillery and brewery. The condition of the pond and the chances of pollution indicate a poor quality of ice. The pond to the north is known as Talbot Lake and is formed by widening out a mill race which is fed by the west branch of Apple Creek. The lake has an area of two and one-half acres, and is kept full of water all the time, and is well stocked with fish making it a desirable recreation ground. The

only danger of pollution is from the numerous visitors to the grounds, but as these come in summer only, the ice is probably of good quality.

West Salem—Local butchers cut, from neighboring ponds, a small amount of ice some of which is used for domestic purposes.

CANAL SYSTEM.

Barberton—The supply for this city is both natural and artificial, though but little of the latter is used and this is shipped from Akron. The natural ice is cut from the canal and Lake Nesmith, a feeder for the canal. Lake Anna, a small natural lake within the city limits, supplies some ice also. All the natural supplies are more or less polluted and their product is of poor quality.

Canal Dover—The supply is entirely from the canal and Sugar Creek, both of which furnish a poor quality.

Canal Fulton—A small amount of ice is cut from the canal feeder north of the village.

Coshocton and Roscoe—The supply is from the canal basin just above the latter village.

Dresden—This village is supplied with natural ice from the Monroe basin of the canal and from the Dresden side-cut.

Navarre—The principal supply is from the canal, though at times some artificial ice is shipped in from Massillon.

Newcomerstown—Natural ice is obtained from the canal basin west of town and is used entirely. This is an especially objectionable place as the canal has just received the refuse of the town.

New Philadelphia—Some ice is cut from the Tuscarawas River, but the major portion is from the canal basin just below Blakes Mills.

Besides the ice cut from the canal system for local consumption, much is cut from the following sources for shipment:

Licking Reservoir—This is an artificial basin built for the supply of the Licking summit of the canal. It is an extensive body of shallow water overgrown with water grass in places and full of stumps. Enormous quantities of ice are cut for the supply of Columbus.

Long Lake, Turkey Foot, Nesmith, Mud, Tuscarawas Reservoir, East Reservoir—These are a group of semi-natural and artificial lakes which supply water for the Ohio Canal. The level of the water is kept up by long earthen embankments, causing much low land to be overflowed. This forms large areas of shallow water which are overgrown with water plants and are full of dead trees and stumps. Large quantities of ice are cut from these, especially from East Reservoir, for the supply of Cleveland, and some for neighboring towns.

Monroe Basin—This is a large basin situated on the line of the canal between Trinway and Adams Mills in the northern part of Muskingum county. The Pennsylvania railroad cuts ice here for its train supply.

Just below this basin large ponds have been made which are filled with water from the canal. Ice is cut from these for the supply of Columbus.

ARTIFICIAL SUPPLIES.

Canton—The greater part of the domestic supply is artificial and it is manufactured by a local company. The water is obtained from shallow wells and is all distilled. It is estimated that about nine thousand tons are made annually, of which one thousand are shipped to Canal Dover, Massillon, Uhrichsville, Minerva, Wooster, Louisville, and other towns of the watershed. The natural ice is cut mainly from Congress Lake, a small body of water in the northern part of Stark county, draining north. The waterworks race also supplies a little ice.

Mansfield—This city is supplied with both natural and artificial ice. The artificial plant runs about nine months in the year and has a capacity of twenty-five tons per day, most of which is used in Mansfield, but some is shipped to neighboring cities, especially when the natural crop is short. The water from which the ice is manufactured is taken from two wells sixty and one hundred feet deep respectively, and is all distilled before being frozen, guaranteeing pure ice.

The natural ice is taken from six artificial ponds east of town; three of these, with a combined area of one and one-half acres, are located just east of the dump and are overflowed by high water from Rocky Fork. The ponds are filthy, poorly kept, and the ice from them cannot help but be badly polluted, some of it is used for domestic purposes. One of the local breweries has a pond on Rocky Fork right across from the city dump; it is extremely filthy and the ice is badly polluted, but it is claimed that this ice is used for cooling purposes only. Another brewery has a pond in the northeastern part of the city which is supplied from Rocky Fork direct. The ice from this would be unfit for domestic use and it is claimed is not so used.

The other pond is one-half mile east of town. It has an area of about four acres and is supplied by two small springs one mile above. This pond is polluted by the surface drainage from a thick rural population and the ice cut from the same is hardly usable.

Massillon—The domestic ice is all artificial and is manufactured in Massillon. The water used for distillation is taken from artesian wells in the northeastern part of town. The company made last year 2,200 tons, a quantity in excess of the local demand. The excess is shipped to Cleveland and to neighboring villages, Orrville, Navarre, etc.

Ice for cooling purposes is cut from the canal and from Sippo reservoir, the former is of very poor quality while that of the reservoir is fair.

Newark—The domestic ice supply is claimed to be entirely artificial, which is supplied by a local company. This company made last year

6,543 tons, two-thirds of which were consumed at home. The ice is made from distilled water, the supply for the stills being obtained from wells. The portion not used at home is sent to Cambridge and Mt. Vernon, and to the B. & O. railroad junctions. The natural ice is obtained from the canal and is of the poorest quality.

Zanesville—The Zanesville Artificial Ice Company ships about four thousand tons annually as stated above, much of which goes to Cambridge, Quaker City, Barnesville, Byesville, Cumberland, Malta, Crooksville, etc. Cambridge, in turn, ships to its neighboring villages, Washington, Salesville, Senecaville, etc.

VI. PUBLIC WATER SUPPLIES.

In the Muskingum watershed there are thirty-one public water works, which supply thirty-two cities and villages containing in all 210,889 people. All of these towns except four have populations of 1,000 or more and are classed as urban. The four are Dalton, Perrysville, Piedmont, and Waynesburg, the combined population of which is only 2,092. Piedmont has a population of only 275, making it one of the smallest villages in the United States provided with a public water supply.

There are eleven towns with a combined population of 16,270 only, 15,070 of which is in the watershed, which are classed as urban, and not provided with public water supplies. These towns and their estimated populations are as follows: Bellville, 1,000; Barnhill, 1,000; Barnesville, 4,000; Byesville, 1,000; Canal Fulton, 1,200; Dresden, 1,400; Loudonville, 1,500; Navarre, 1,170; Newcomerstown, 1,800; Roseville, 1,000; and Somerset, 1,200.

Barnesville, with an estimated population of 4,000, is the second largest town in the state which is unprovided with a public water supply. This is a condition which should not exist any longer than absolutely necessary, for when a town reaches the size of Barnesville, it has usually so polluted its ground water that the use of ordinary wells is very objectionable. It must be pointed out here, however, that there are many much larger places, which, though provided with public water supplies, must still depend on private wells for water for domestic use on account of the notoriously bad character of the publicly provided water. The natural result of this is a typhoid death rate much above the normal, which is itself too large in this state, and in this country for that matter.

Several of the towns in the above list are discussing the question of putting in a public supply and it is to be hoped that the near future will see active steps taken in this direction. There has been invented no method of carrying off the wastes of the human economy which is as sanitary, unobjectionable and cheap as the water-carrying system, and the sooner a growing village recognizes the fact that a good potable public water supply in connection with a good system of sewers will do more for the prosperity of the village and for the health of the people than any other public improvement, the better it will be for them, both socially and financially. Three of the towns in this same list, which are but fossils of themselves, will never recognize the above fact and will drag out their weary existence until they dwindle away or until some new excitement sets them on their feet again.

CLASSIFICATION.

For convenience in studying the public water supplies they have been divided with reference to source into Surface, Ground, and Surface and Ground waters.

These divisions are comparatively easy to make; if a supply is obtained from a stream direct, a lake, or from an impounding reservoir, it is placed in the "Surface" class; if the supply is from wells or galleries of any kind, not simply as a method of filtering, however, it is put in the "Ground" class; while a combination of these will cause it to be placed in the third named class.

The next step in the classification, namely the separation of the ground supplies into sub-surface and deep-seated supplies, was not so easy to make. The division has been made according to the definitions given in the last report on this work, namely, "to place in the sub-surface class all ground supplies the purity of which is easily influenced by surface pollution, and to place in the deep-seated class those supplies which are drawn from such depth and through such strata that the surface conditions can have but little if any influence." This line is hard to draw in some cases, but most of the public supplies will fall naturally into their proper places and thus give another base to work on when considering the public supplies as a whole.

According to the above definitions of the various classes, the following table has been prepared:

TABLE VII—CLASSIFICATION OF PUBLIC WATER SUPPLIES.

		Town.	Population.
(A) Surface			
	{	1—Cambridge	7,000
		2—Dennison and	5,000
		3—Uhrichsville	5,200
		4—Marietta*	12,500
		5—Zanesville	24,008
		Total	53,708
		Average	10,741
(B) Ground ..			
	{ Subsurface		
		1—Ashland	4,160
		2—Barberton	1,800
		3—Canal Dover	4,000
		4—Coshocton	5,000
		5—Granville	2,500
		6—McConnelsville	5,212
		7—Millersburg	2,026
		8—Mineral Point	1,200
		9—Minerva	1,250
		10—Mt. Vernon	6,825
		11—New Philadelphia	6,231
		12—Piedmont	275
		13—Shelby	3,500
		14—Wadsworth	2,000
		15—Waynesburg	500
		Total	46,479
		Average	3,099
	{ Deep-seated ...		
		1—Carrollton	1,500
		2—Dalton	750
		3—Louisville	1,628
		4—Mansfield	20,000
		5—Orrville	2,000
		6—Perrysville	567
		7—Scio	1,800
		8—Shreve	1,115
		Total	29,360
		Average	3,670
		Total	75,839
		Average	3,293

TABLE VII — CLASSIFICATION OF PUBLIC WATER SUPPLIES — Concluded.

			Town.	Population.
(C) Surface and ground.	Surface and subsurface ..	{	1—Newark	20,386
			2—Wooster	5,956
			Total	26,342
			Average	13,171
	Surface and deep-seated .	{	1—Canton	40,000
			2—Massillon	15,000
			Total	55,000
			Average	27,500
		Total	81,342	
		Average	20,335	
		Grand Total.....	210,889	
		General Average.....	6,590	

* Marietta is supplied from Ohio River.

From the above table it is seen that there are only five towns supplied wholly by surface water, and it might be added that two of these are now seeking a new supply from ground sources; Dennison and Uhrichsville, will soon be supplied with filtered water of good quality and will continue in the surface class, and Marietta draws her water direct from the Ohio River and will probably continue to do so for some time.

In the surface and ground class there are four towns, two in each division of the same, which have bettered their surface supplies by the addition of some ground water or have helped out their ground supplies with a little surface water. Newark is the only one of the four that originally was supplied entirely by ground water and on account of the shortness of the same was compelled to use surface water. The remaining three, Wooster, Canton, and Massillon, were originally all supplied with surface water and have tried to better their supplies with additions from ground sources. Canton has put in a large number of wells and is now seeking a location for more of them in the hope of being able to do away with all its surface supply. Massillon has solved this question by obtaining a deep-seated water for domestic use and retaining its old surface supply for manufacturing purposes, for which it is better suited than the ground water. Wooster is in a bad shape, it has a poor surface supply and such poor facilities for caring for its ground water that this also soon becomes unusable.

These nine towns, the water supplies of which are either entirely or in part from surface sources, have a combined population of 135,050

which is sixty-four per cent. of the total population of the thirty-two towns supplied with water. The five towns which are supplied entirely by surface water have a population of 53,708, which is twenty-five per cent. of the total population. These figures bring out very forcibly the inability of most of the larger cities to obtain, with reasonable expense, sufficient ground water for their needs. Mansfield is the only city, of any size, in the watershed that is supplied entirely with ground water.

Twenty-three towns with a total population of 75,839 are supplied entirely with ground water, fifteen of which use subsurface water and eight deep-seated water. Even some of these small places at times experience difficulty in obtaining enough water, and as these towns grow and the use of water becomes more general this difficulty will increase. Some may be able to increase their supplies from ground sources, a few may have to seek help from the neighboring streams, at the expense of purity. Much of this shortness of supply is due to the waste of water by the consumers and steps should be taken to cut this down before more water is sought for, which only encourages this waste. The question of a sub-surface or deep-seated supply is not a general one, but usually merely one of local geology.

The class of town, that is, manufacturing or not, has a bearing on this question as the deep-seated water is very objectionable for many industrial uses. On this account and also on account of the easier development, subsurface supplies are more common than the deep-seated ones. If the sub-surface water is collected in a district free from local pollution, it is usually of good quality and as a rule better than many deep-seated supplies because of the mineral nature of many of the latter. But subsurface supplies collected within the limits or even close to growing towns, where the soil is already loaded with filth, are not to be considered as desirable; the water may be perfectly wholesome at the present time and may continue to be for some time to come, owing to the filtering action of the soil, but it is impossible to say just how long this filtration will be efficient and it is folly to run this risk when it can be avoided by collecting the supply from a locality free from this objection, even if it is done at a small expense of convenience and money. There are all too many people who are difficult to convince of the truth of the statement.

DETAILED DESCRIPTION OF PUBLIC WATER SUPPLIES.

Under this heading there will be given a brief description of each plant as in the former reports along this line, but for the sake of brevity the franchises of the private water companies and the question of water rates will be considered separately, later on.

The supplies for the following named cities and villages have been described in the "First Report on the Condition of the Public Water Supplies of Ohio," which is contained in the Thirteenth Annual Report of the Board:—Ashland, Canton, Cambridge, Dennison and Uhrichsville, Mas-

sillon, Marietta, Wooster, and Zanesville. The description of the supply of Wadsworth is contained in a special report in the same volume. These descriptions have been brought up to date in the tabulated report on the public water supplies of the Muskingum Watershed, submitted with this report. (See Table 8).

Barberton—Population 4000. The public water supply was put in by the village in 1892 and has cost to date \$13,000. The cost represents mains and hydrants only, as the water is purchased by the city from three large manufacturing establishments which not only furnish the water but also supply the pressure. These plants have one well each, all of which are about 14 feet deep and 16 feet in diameter. They are located in beds of gravel and soil near the canal from which some at least of the water comes. The water is pumped direct by four pumps located in the various factories, one only of which keeps up the pressure and the others are held in emergency for use in case of fire, for which purpose the system was designed. These pumps consist of a horizontal, compound Worthington of 640,000 gallons capacity, a Hooker pump of 320,000 gallons capacity, and two others of 512,000 gallons capacity each, making a total daily capacity of 1,984,000 gallons.

There are 4.3 miles of mains in, to which 90 per cent of the people have access. There are 97 services in, of which 94 are in use and none metered.

The average daily consumption is impossible to estimate but it is not important as this supply is not used at all for domestic purposes. There is talk of obtaining a potable water supply and it is highly desirable that such action be taken.

Canal Dover—Population 5,212. The public water supply was put in by the village in 1895 and has cost to date \$39,330. The water is obtained from six six-inch wells driven from 51 to 61 feet into a large bed of sand and gravel located in the southern part of the village right on the bank of the Tuscarawas River. Four of the wells were put in with the plant in 1895 and two more were added in 1897. The water rises to within ten feet of the surface when the wells are not being pumped and it is lowered but little by pumping, at least not below the suction limit as the pumps are connected direct.

The water is pumped to a standpipe by two horizontal, compound, duplex Worthington pumps of 750,000 gallons capacity each. The standpipe is 100 feet high and 16 feet in diameter, giving a capacity of 150,000 gallons and a pressure when full of 60 pounds at the station.

There are 9.5 miles of mains in, to which 90 per cent of the people have access. There are 331 services in, of which 330 are in use and four metered. The average daily consumption is 75,108 gallons, which gives an average daily consumption per capita of the village of 14 gallons and per consumer of 38 gallons.

This supply is of good quality and is not in as general use as it should be.

Carrollton—Population 1,500. The public water supply was put in by the village in 1895 and has cost to date \$66,000. The water is taken from five eight-inch drilled wells which are 100 feet deep and go through 17 feet of loam and shale, and 83 feet into sandstone. The normal level of the water is eight feet below the surface and this is lowered to 27 or 28 feet during pumping.

The water is pumped direct from the wells to a stand-pipe, which is 16 feet in diameter and 73 feet high, giving a capacity of 103,000 gallons and a domestic pressure of 60 pounds. The pumps consist of two horizontal, compound, duplex Worthingtons of 750,000 gallons capacity each.

There are 4.5 miles of mains, giving 85 per cent of the people access to the water. There are 200 services, all of which are in use and none metered. The average daily consumption is 65,710 gallons, which is 44 gallons per capita and 55 per capita of the population actually supplied. This supply is in general use for domestic purposes.

Coshocton—Population 5000. The public water supply was put in by the village in 1892 and has cost to date \$66,000. The supply is from twenty-two six-inch wells driven from 31 to 32 feet into the sandy point between Walhonding Creek and the Tuscarawas River. The level of the water in the wells is the same as that in the streams, usually about eight feet below the surface, and it is lowered but little during pumping. In fact the level cannot be lowered much on account of the distance of the wells both away from and below the pumps. The water is pumped direct from the wells to a covered brick reservoir of 324,000 gallons capacity, which is located on a hill east of town of such height as to give a pressure of 115 pounds. The pumps in use consist of a vertical, compound, duplex Hughes of 1,250,000 gallons capacity and one horizontal, compound, duplex Hughes of 600,000 gallons capacity. There are 13 miles of main in, giving 90 per cent of the people access to the water. There are 800 services in, of which 780 are in use and eight metered. The average daily consumption is 500,000 gallons or 100 gallons per capita of the village and 106 gallons per consumer. As seen from this the water is in use by nearly every one.

Dalton—Population 750. The public water supply was put in by the village in 1895 and has cost to date \$7,500. The water is obtained from a well 200 feet deep in sandstone all the way. The well was drilled six inches in diameter for part of the way then sent down to the above depth only four inches in diameter. The water is pumped by a deep well pump, operated by wind power, to a reservoir located at the side of the well and then flows by gravity to the town to the east. The pump cylinder is 150 feet below the surface and the water can be lowered to the suction

limit below this ; the normal level of the water is 40 feet below the surface. The deep well pump-was formerly operated by steam but owing to the fact that the well is on a high hill where a good wind power could be developed the change was made. The wind wheel is of the self-adjusting pattern and requires no attention beyond the occasional setting and oiling. With this power the pump can handle about 10,000 gallons daily. The reservoir is a circular brick well covered with a tin roof and holding 140,000 gallons. In addition to the well supply a spring located in town has been impounded in a reservoir of 36,000 gallons capacity, which is used only when the well supply is shut off for repairs or lack of wind.

There are 2.5 miles of mains in, which gives 85 per cent of the people access to the water. There are 37 services in, of which 32 are in use and none metered. Only three of the services are for house use, the others being for sprinkling and stable use. The average daily consumption is about 3,900 gallons, which is five gallons for each person in the village or 20 for each consumer. This supply is not used at all, it may be said, for domestic purposes.

Granville—Population 1800. The public water supply was put in by the village in 1884 and has cost to date \$15,000. The supply is from three four-inch wells driven 45, 50 and 55 feet respectively into a bed of gravel, located south of the village in the valley of Raccoon Creek. The water is pumped direct from these wells to an elevated tank by one horizontal, compound, duplex Knowles pump of 350,000 gallons capacity.

The tank is 32 feet in diameter, 20 feet high, and has a capacity of 100,000 gallons. It is constructed of wood and covered with a conical board roof, and is located on a hill just north-west of the village. The domestic pressure is 80 pounds. There are 6.75 miles of mains in, giving 80 per cent of the people access to the water. There are 206 services in, all of which are in use and six metered. The average daily consumption is 50,000 gallons, which is 28 gallons per capita of the village and 40 for each consumer. The water is in general use throughout the village.

Louisville—Population 1628. The water supply was put in by the village in 1894 and has cost to date \$18,000. The supply is obtained from two eight-inch wells which were drilled 110 feet deep going through soil and-shale into a bed of gravel. The normal level of the water is from 8 to 10 feet below the surface and it has never been lowered the suction limit.

The water is pumped direct from the wells to a standpipe by two horizontal, duplex Boisard pumps of 500,000 gallons capacity each. The stand-pipe is 16 feet in diameter, 100 feet high, and has a capacity of 150,000 gallons. The domestic pressure varies from 45 to 50 pounds on the main streets. There are 3.5 miles of mains in, which give 90 per cent of the people access to the water. There are 165 services in, of which 159 are in use and none metered. The average daily consumption is 40,000

gallons, which is 25 gallons per capita of the village and 42 gallons per capita of the population actually supplied. The water is of good quality and is used for domestic purposes by those who have access to it.

Mansfield—Population 20,000. The public water supply was put in by the city in 1870 and has cost to date \$566,000. The water supply is from three groups of wells, one group is near the pumping station in the northern part of the city near Rocky Fork, another one-fourth of a mile above this near the Pennsylvania railroad and the third on Bloom street nearer the central portion of the city.

The station wells were the original supply and were added to until the water in this section was exhausted, then in 1889 and 1896 the gang one-fourth of a mile above were put in, and in 1896 the Bloom street wells were also drilled. In the group near the station there are ten 4-inch wells and one 10-inch well, which vary in depth from 150 to 210 feet, and are all in a bed of quick sand. This gang is pumped to a receiving well by a horizontal, duplex Blake pump of 750,000 gallons capacity and supplies about 375,000 gallons daily.

The group one-fourth mile above the station consists of five 5-inch wells and one 10-inch well, all 180 feet deep. These wells go through soil and gravel and 60 feet into sandstone rock. The water from these flows to the receiving well by gravity. A centrifugal pumping plant will shortly be installed here, which, it is claimed, will increase the capacity of this group to 2,000,000 gallons daily.

There are two wells in the Bloom street group, each ten inches in diameter, and 180 feet deep. These go through the surface soil, gravel, and clay into a bed of quicksand. The water flows by gravity from these wells to the station. The pump well is 35 feet in diameter and 30 feet deep, and is walled up with stone and housed over. The water is pumped from this well direct to the mains by two horizontal, compound, duplex Gordon pumps of 2,000,000 and 1,750,000 gallons capacity respectively. By closing down the valve in one supply main two pressures are maintained, one of 125 pounds and the other of 80.

There are 52.0 miles of mains in use which give about 70 per cent. of the people access to the water. There are 2,000 services in, of which 1,950 are in use and 35 metered.

The average daily consumption is about 2,000,000 gallons, which is 100 gallons per capita of the city and 170 gallons for each consumer. The water is in general use by all those able to obtain it.

McConnelsville—Population 2,500. The public water supply was put in by the village in 1899 and has cost to date \$20,000. The supply is from four 6-inch wells 42 feet deep, and located in the river bottom just above the village. The wells go through 18 feet of loam, sand, and gravel, and a thin layer of hard pan, then into the water-bearing gravel. The normal level of the water in the wells is 17 feet below the surface and it is lowered but little by pumping. The water is pumped direct from the wells to an

open brick reservoir by a horizontal duplex Stillwell-Bierce and Smith-Vaile pump of 750,000 gallons capacity. The reservoir has a capacity of 275,000 gallons and is placed on a hill back of the village where it gives a pressure of 100 pounds.

There are 3.75 miles of mains in, to which 75 per cent. of the people have access. There are 55 services in, of which 20 are in use and none metered. The plant is hardly in running order yet and the average daily consumption could not be obtained. The supply seems to be of good quality and its use should be encouraged.

Millersburg—Population 2,026. The public water supply was put in by the village in 1895 and has cost to date \$27,000. The water is obtained from a well 30 feet in diameter and 28 feet deep, located just west of the village in the bottom land of the creek and 50 feet from the latter. The well is walled up with brick and is covered with a conical board roof. It goes through loam and muck into a bed of gravel where the water is found. The normal level of the water is above that in the creek and varies from 15 to 24 feet from the surface and is but seldom lowered below the latter figure. The water is pumped direct from the well to a covered reservoir by a horizontal, compound, duplex Stillwell-Bierce pump of 750,000 gallons capacity. The reservoir has a capacity of 150,000 gallons and is constructed of brick and covered with a tin roof; it is located on a hill just east of the village and gives an average pressure of 80 pounds.

There are 6.0 miles of mains in, to which 90 per cent. of the people have access. There are 250 services in, all of which are in use, and three metered. The average daily consumption is 150,000 gallons, which is 74 gallons per capita of the total population and 100 gallons for each consumer.

Minerva—Population 1,250. The public water supply was put in by the village in 1886 and has cost to date \$16,000. The supply was first obtained entirely from the Clear Fork of Sandy Creek, then from an infiltration well placed at the side of this creek in the upper part of the village; then this supply was supplemented later on by drilling a 6-inch well 55 feet deep all in sand and gravel. The infiltration well is nine feet square, boarded up with plank, and 10 feet deep; the water enters it through the quicksand in the bottom. At times the creek covers this well and the deep well is used entirely. Normally each well supplies about half of the water. When not pumping the water stands six feet from the surface, or a little above the creek level, and when pumping is easily lowered to the suction limit. The water is pumped direct from these wells to an elevated tank by a horizontal, duplex, Smith-Vaile pump of 250,000 gallons capacity, and by a horizontal, compound, duplex Worthington pump of 600,000 gallons capacity. The tank is 20 feet high, and 24 feet in diameter, giving a capacity of 65,000 gallons, and is

placed on a frame trestle located on a hill north of the village where it gives a pressure of 50 pounds.

There are 5.5 miles of mains in, giving 90 per cent. of the population access to the water. There are 183 services in, of which 168 are in use and none metered. The average daily consumption is 125,000 gallons, which is 100 gallons per capita of the village and 125 for each consumer. The public supply is in general use and seems to be of good quality.

Mt. Vernon—Population 6,825. The public water supply was put in by the village in 1882 and has cost to date \$115,000. The original supply was from two large wells, one 20 feet in diameter and the other seven feet, and both 21 feet deep. The larger of these wells has been filled up until it is now 10 feet deep and is used as a receiving well. The smaller is used as a pump well, the water flowing from the receiving well to it by gravity. The supply is now obtained from 21 driven wells which have been put in from time to time as the consumption increased. These consist of nine 6-inch wells, four 4-inch, eleven 2-inch, and two 3-inch, which vary from 60 to 90 feet in depth, the average being 73 feet. The wells go through a surface layer of sand and gravel, then through a layer of hard pan and into the water-bearing gravel. The wells are all artesian and the natural flow only is utilized; five, however, have ceased to flow now. The sand found through the gravel stops the flow in a comparatively short time and the wells have to be blown out to keep the flow up. The supply is just about equal to the demand now and it is intended to put in more wells shortly. The water is pumped to a standpipe by a horizontal, compound, duplex Worthington pump of 750,000 gallons capacity and by a horizontal, compound, duplex McGowan pump of 1,000,000 gallons capacity. The standpipe is 25 feet in diameter, 57 feet high with a capacity of 209,290 gallons and furnishes an average pressure of 100 pounds.

There are 19.0 miles of mains in, giving 95 per cent. of the people access to the water. There are 1,100 services in, of which 1,025 are in use and none metered. The average daily consumption is 858,510 gallons, which is 126 gallons per capita of the village and 140 for each consumer. The wells are located in the western part of the village in the bottom land of the Kokosing River, a large area of which is under the control of the village and is laid out for a public park so as to protect the water supply.

The water is of excellent quality and will continue to be so as long as the present enlightened policy is pursued.

Mineral Point—Population 1,200. The public water supply was put in by the village in 1899 and has cost to date \$12,000. The water is obtained from four springs impounded in a reservoir of 169,000 gallons capacity and supplying the village by gravity at a pressure of 80 pounds. The reservoir is 60 feet in diameter, eight feet deep, and is built of brick and covered with a slate roof. The springs come from under rather steep hills which are located in a thinly settled farming district about

one mile northeast of the village. For fire purposes a reserve supply is stored in an open reservoir of 88,000 gallons capacity, which is located down in the village. The pressure is obtained by a horizontal, duplex Battle Creek pump of 720,000 gallons capacity.

There are 3.0 miles of mains in, giving 90 per cent. of the people access to the water. There are 100 services in, all of which are in use and none metered. It is impossible to estimate the amount of water used.

Newark—Population 20,386. The public water supply was put in by a private company, the Newark Water Company, in 1886, and has cost to date about \$250,000. The water was at first obtained from two brick-lined wells, 21 feet deep and 20 feet in diameter, dug in a gravel bed about a mile north of the city near the North Branch of Licking Creek. Later these wells were supplemented by twenty-four 4-inch Cooke driven wells located at the same place. The supply still being short, a small brush and stone dam was put in the creek and this water diverted to one of the large wells which serves as a pump well. All the wells are in sand and gravel, the deeper ones just reaching a layer of hard pan below this bed. The normal level of the water is about 10 feet below the surface and it is lowered but four or five feet by pumping. The pumps are attached direct to the Cooke wells and to one of the large wells, the other flowing to this one through a siphon. The water is pumped to an open reservoir by two horizontal, compound, duplex, Gordon-Maxwell pumps of 2,500,000 gallons capacity each. The reservoir is about 250 by 60 feet and 12 feet deep with an available capacity of about 850,000 gallons, and is located on a hill across the creek from the pumping station and at such a height as to give a pressure of 114 pounds. It is excavated in the top of the hill and the sides formed of earthen embankments, puddled and roughly paved. No trouble has been experienced from growths.

There are 27.0 miles of mains in, to which 80 per cent. of the people have access. There are 1,453 services in, of which 1,170 are in use and 260 metered. The average daily consumption is 1,297,890 gallons, which is 64 gallons per capita of the city and 185 gallons for each consumer. As seen, the water is not in general use in the city, but its quality is good, much better than private well water. The surface water is only used during good stages of the creek and in this way is not so objectionable, though the run-off of a thickly settled farming district is not of the purest. The large average daily consumption per consumer is due to the use of the water by one of the railroads.

New Philadelphia—Population 6,231. The public water supply was put in by a private company, "The New Philadelphia Water Company," in 1886, and has cost to date about \$100,000, which sum probably includes the prerequisite necessary for the successful establishment of a private water company.

The supply was first taken from an infiltration well at the edge of the Tuscarawas River, just south of the village. In 1892, eight 6-inch wells,

30 feet deep, were put down in a large gravel deposit in the low land along the river and near the old infiltration well. In 1896 six 6-inch wells, 80 feet deep, were put down in the same vicinity, and in 1898, two more of the same kind were put in. The normal level of the water is 11 feet below the surface and it is lowered 15 to 18 feet by pumping.

The old infiltration well is now connected directly with the river and can be drawn upon in case of fire. The water is pumped direct from the driven wells to a reservoir by two horizontal, duplex, Blake pumps of 1,000,000 gallons capacity each, and by one horizontal, compound, duplex, Laidlaw-Dunn-Gordon pump of 2,000,000 gallons capacity. The reservoir is located on a hill east of the village and at such a height as to give a pressure of 100 pounds. It is oval in shape, 200 by 100 by 13 feet deep, and has a capacity of about 1,250,000 gallons. The bottom of the reservoir is lined with a mixture of cement and clay, the sides are ripped, and the whole covered with a board roof.

There are 15.0 miles of mains in, to which 90 per cent. of the people have access. There are 600 services in, 575 of which are in use and eight metered. The average daily consumption is 600,000 gallons which is 96 per capita of the village and 175 gallons per consumer. The wells are removed from any local pollution and seem to furnish a good water.

Orrville—Population 2,000. The public water supply was put in by the village in 1894 and has cost to date \$25,000. The supply is from four 8-inch wells which vary from 114 to 121 feet in depth. The wells went through from 10 to 16 feet of soil, then struck the rock which is a conglomerate of the Waverly group. The water rises above the surface when the wells are not being pumped and it is lowered only from 10 to 12 feet during the hardest pumping. The supply is pumped direct from the wells to the mains and a domestic pressure of 70 pounds is maintained by two horizontal, compound, duplex, Laidlaw-Dunn-Gordon pumps of 1,500,000 gallons capacity each.

There are 6.0 miles of mains in, to which 90 per cent. of the people have access. There are 268 services in, 260 of which are in use and none metered. The average daily consumption is 141,858 gallons, which is 71 gallons per capita of the total population and 91 per capita of the population actually supplied. The water is in general use and is of good quality both for domestic and manufacturing use. A good deal of water is used by the railroads passing through the town.

Perrysville—Population 567. The public water supply was put in by the village in 1894 and has cost to date \$7,200. The supply is from one 6-inch well 93 feet deep, 53 feet of which is sandstone rock. The well is located just north of the village and away from all local pollution. The water is pumped to a small reservoir by a Smith-Vaile deep well pump of 112,000 gallons capacity. The normal level of the water is 25 feet below the surface and the well can be pumped dry as the water cylinder is 75 feet down. The reservoir is of 54,000 gallons capacity and consists

of a brick cistern covered with a shingle roof, and is located on a hill back of the pumping station and at such height as to give a pressure of 75 pounds in the village.

There are 2.5 miles of mains in, giving 95 per cent. of the people access to the water. There are 100 services in, all of which are in use and five metered. The average daily consumption is 10,000 gallons, which is 18 gallons per capita of the village and 20 per consumer. The water is in very general use in the village to the exclusion of the private wells. The absence of baths and water closets keeps the consumption very low.

Piedmont—Population 275. The public water supply was put in by a private company, "The Piedmont Water Supply Company," in 1894, and has cost to date \$1,650. The supply is obtained from two springs located on the neighboring hills, the water from which is impounded in a reservoir and conducted to the village by gravity. The reservoir consists of a vaulted stone cistern with a capacity of 12,500 gallons, and is at such a height as to give a pressure of 55 pounds on the streets.

There are 0.76 miles of mains in, which give about 50 per cent. of the village access to the water. There are 30 services in of which 25 are in use and none metered. Owing to the nature of the supply it was impossible to estimate the consumption. The springs emerge from a bed of shaley sandstone in the side of the hills and the water appears to be of good quality.

Scio—Population 1,800. The water supply was put in by a private company, "The Scio Water Supply Company," in 1899, and has cost to date about \$30,000. The plant was originally designed to protect Scio against the great danger from fire on account of the oil boom. The water is obtained from two 8-inch wells and one 6-inch well, all 110 feet deep. Two of the wells go through quicksand into sandstone rock and one goes through rock into a broken strata of rock and clay. The normal level of the water is two feet from the surface and it is lowered but little by pumping. The wells are located in the valley of Conotton Creek just below the village and would be badly polluted by the dirty drainage of the latter if they were not carefully cased in. The water is pumped direct from the wells to two elevated tanks, by two horizontal, duplex, Laidlaw-Dunn-Gordon pumps of 500,000 gallons capacity each. The tanks are constructed of steel, each 18 feet in diameter and 25 feet high, with a combined capacity of 95,000 gallons. They are placed on a hill back of the pumping station and at such a height as to give an average pressure of 100 pounds.

There are 4.0 miles of mains in, which give 75 per cent. of the people access to the water. There are 39 services in, all of which are in use and none metered. The average daily consumption is 31,500 gallons, which is 17 gallons per capita of the village and 150 gallons for each consumer.

Shreve—Population 1,115. The public water supply was put in by the village in 1893 and has cost to date \$9,416. The water is obtained from an 8-inch well 142 feet deep, located in the upper part of the village. The rock is very near the surface at this point and the well required but little casing. The water is pumped by a Laidlaw-Dunn-Gordon deep well pump of 100,000 gallons capacity, to a small brick cistern from which it is pumped to a reservoir by a horizontal, duplex, Miller pump of 150,000 gallons capacity. The cistern has a capacity of 3,300 gallons and the reservoir, one of 88,200 gallons. The latter is constructed of brick, covered over, and is 30 feet in diameter and 16 feet deep. It is located on a hill north of the village at such height as to give a pressure of 80 pounds. It is cleaned every year and has given no trouble from growths.

There are 2.5 miles of mains in, giving 90 per cent of the people access to the water. There are 85 services in, all of which are in use and *all* metered. The average daily consumption is about 30,000 gallons, which is 27 gallons per capita of the total population and 70 gallons for each consumer. The water is of good quality and is used for domestic purposes by every one having access to it.

Shelby—Population 3,500. The public water supply was put in by a private company, "The Shelby Water Company," in 1897, and has cost to date \$106,000. The supply is from twelve 6-inch wells, 46 feet deep, located in the low land to the northwest of the village and bordering Black Fork. The wells were steam excavated and go through clay and sand, gravel and blue clay, into a stratum of gravel in which the water is found. The normal level of the water in the wells is five feet from the surface and the supply has been so abundant that the level is seldom lowered more than a foot by the pumps. The creek at times overflows the land occupied by the wells, but it is claimed the turbidity of the well water does not increase during such times, showing no intimate connection between the surface water and that obtained from the wells.

The water is pumped direct from the wells to a standpipe by two horizontal, compound, duplex, McGowan pumps of 2,000,000 gallons capacity each. The standpipe is 16 feet in diameter and 145 feet high, giving a capacity of 100 pounds. There are 13.0 miles of mains in, giving 90 per cent. of the people access to the water. There are 500 services in, all of which are in use and one metered. The average daily consumption has been 1,000,000 gallons during the past year on account of the large amount used in constructing and flushing the new sewer system. With the above figure the average per capita of the total population would be 286 gallons and for each consumer 330 gallons. The water is pretty highly impregnated with iron and is objectionable to many on this account for domestic use.

Waynesburg—Population 500. The public water supply was put in by a private company, "The Waynesburg Water Company," in 1857, and

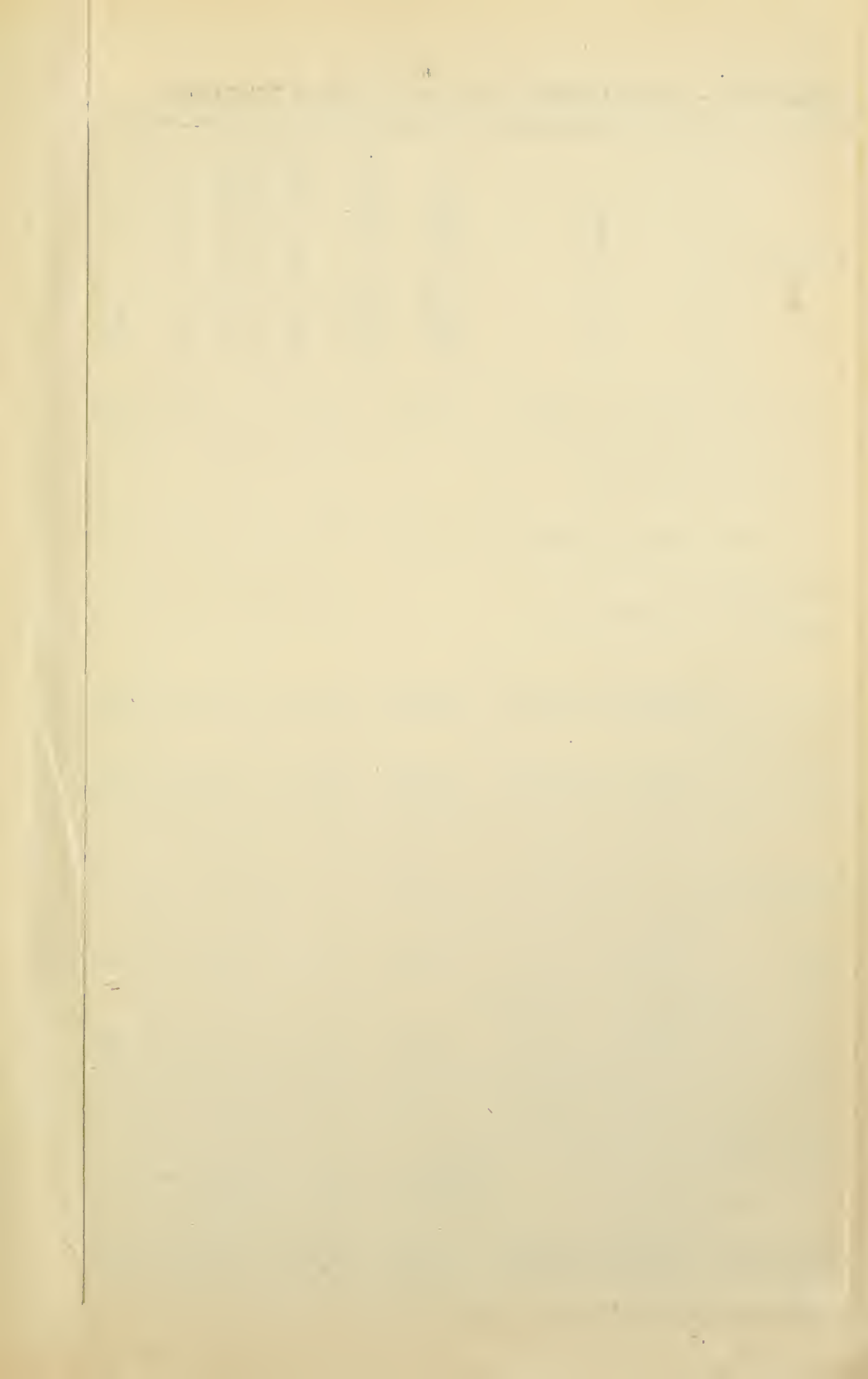


TABLE VIII.—DESCRIPTION OF PUBLIC WATER SUPPLIES

Number	Name of Town	Estimated Population for 1900	Ownership of Water-Works	Date of Installation	Cost of Plant (Dollars)	Source of Supply	Method of Supply	Capacity of Reservoir or Standpipe (gallons)	Diameter Pressure in Feet	Number of Miles of Main	Percent of Population Having Access to Water	Number of Servants in	Number of Servants in	Number of Servants in	Pumps	Total Pumping Capacity (Gallons per 24 Hours)	Average Daily Consumption, in Gallons	Average Daily Consumption, in Gallons	Average Daily Consumption, in Gallons	Average Daily Consumption, in Gallons	
1	Ashland	4,150	Public	1885	50,750	2 Wells, 16 and 18 feet deep	Pumping to Standpipe	176,000	75	13	0	65	380	380	20	2 Hor. comp. Smith-Vale, 1,000-gal. each	2,000,000	108,880	35	48	
2	Barbours	4,000	Public	1892	13,000	4 Wells, each 14 feet deep	Pumping Direct	...	...	4	0	90	97	94	...	1 Hor. comp. Worthington, 500-gal. each; 1 Hor. comp. z, each 512-gal.	1,984,000	Impossible to estimate	...	...
3	Canal Dover	5,282	Public	1895	39,350	6 1/2-in. Wells, 51-61 feet deep	Pumping to Standpipe	150,000	60	9	0	90	331	330	4	2 Hor. comp. dup Worthington, 750-gal. each	1,500,000	72,138	14	30	
4	Canon	10,000	Public	1869	400,000	36 1/2-in. Wells, 225-365 feet deep	Pumping Direct	40	10	0	79	4,118	4,000	41	2 Hor. comp. dup Worthington, 2,000-gal. each; 1 Hor. comp. dup Holly, 8,000-gal.; 1 Hor. dup Gordon, 4,000-gal.	14,000,000	2,848,831	71	110
5	Cambridge	7,000	Public	1890	65,000	Wells, Creek	Pumping to Standpipe	300,000	50	12	0	70	490	140	130	2 Hor. comp. dup Laidlaw-Dunn-Gordon, 1,500-gal. capacity each	3,000,000	600,000	37	440	
6	Carrollton	7,000	Public	1895	25,500	1 1/2-in. Wells, 100 feet deep	Pumping to Standpipe	103,000	60	4	0	85	200	200	...	2 Hor. comp. dup Worthington, 750-gal. each	1,500,000	65,710	44	55	
7	Chesham	7,000	Public	1892	60,000	22 1/2-in. Wells, 51-62 feet deep	Pumping to Reservoir	324,000	100	13	0	90	880	760	8	1 Vert. comp. dup Hughes, 1,500-gal.; 1 Hor. comp. dup Hodge, 4,000-gal.	1,850,000	500,000	100	166	
8	Dalton	750	Public	1895	7,500	1 Well, 178 ft. deep	Pumping to Reservoir	140,000	...	2	0	85	37	37	...	2 Hor. well wind pump, about 10,000 gallons capacity	10,000	3,900	5	59	
9	Danvers Churchville	2,000	Private	1888	245,000	Big Safford's Creek	Pumping to Reservoir	2,000,000	100	12	0	70	200	200	1	1 Hor. comp. dup Hodge, 1,500-gal.; 1 Hor. comp. dup Worthington, 1,000-gal.	3,000,000	1,772,054	174	421	
10	Granville	1,000	Public	1884	15,000	4 1/2-in. Wells, 45-55 feet deep	Pumping to Elevated Tank	100,000	...	6	0	75	80	230	20	6	1 Hor. comp. dup Knowles, 350,000 gallons capacity	350,000	50,000	38	40
11	Louisville	1,000	Public	1891	18,000	2 1/2-in. Wells, 110 feet deep	Pumping to Standpipe	100,000	...	10	0	75	90	165	150	...	2 Hor. duplex Bonard, 200-gal. each	1,500,000	40,000	25	42
12	Mansfield	9,000	Public	1870	500,000	10 1/2-in. Wells, 4 1/2-in. Wells, 150-210 feet deep	Pumping Direct	Storage Reservoir, 2,500,000	125	52	0	70	2,000	1,700	350	1	1 Hor. comp. dup Gordon, 2,000-gal.; 1 Hor. comp. dup Laidlaw, 1,500-gal.; 1 Hor. duplex Blake, 750-gal.	4,500,000	2,000,000	100	170
13	Massillon	15,000	Private	1854	...	1 1/2-in. Wells, 200 feet deep	Pumping to Standpipe	500,000	30,000,000	20	0	70	1,300	1,300	75	1 Hor. comp. dup Deane, 2,000-gal.; 1 Hor. comp. dup Laidlaw, 1,500-gal.; 1 Vert. comp. dup Smith-Hughes, 2,000-gal.	4,500,000	2,000,000	100	170	
14	Marietta	11,500	Public	1890	132,000	Other River	Pumping to 2 Elevated Tanks	1,500,000	...	57	0	70	1,700	1,600	...	1 Vert. comp. dup Gordon, 2,000-gal.; 1 Hor. comp. dup Laidlaw, 1,500-gal.; 1 Vert. comp. dup Smith-Hughes, 2,000-gal.	4,500,000	2,000,000	100	170	
15	McConnelsville	2,500	Public	1890	20,000	1 1/2-in. Wells, 42 feet deep	Pumping to Reservoir	275,000	100	1	0	75	55	20	...	1 Hor. comp. dup Stillwell-Burce, 750-gal. capacity	750,000	1,000,000	80	130	
16	Milburg	2,000	Public	1895	25,000	1 3/8-in. Well, 30 feet deep	Pumping to Reservoir	150,000	...	40	0	70	250	250	...	1 Hor. comp. dup Stillwell-Burce, 750-gal. capacity	750,000	100,000	71	100	
17	Minerva	1,250	Public	1896	16,000	1 Infiltration Well, 1 1/2-in. Well, 50 feet deep	Pumping to Elevated Tank	10	0	75	30	103	100	...	1 Hor. comp. dup Smith-Vale, 200-gal.; 1 Hor. comp. dup Worthington, 1,000-gal.	850,000	125,000	100	125
18	Mt. Vernon	8,000	Public	1892	115,000	1 1/2-in. Wells, 2 1/2-in. and 1 1/2-in. Wells, 30 to 80 feet deep	Pumping to Standpipe	240,200	100	10	0	85	1,100	1,025	...	1 Hor. comp. dup Worthington, 750-gal.; 1 Hor. comp. dup McGowan, 1,000-gal.	1,750,000	858,810	129	140	
19	Mineral Point	1,000	Public	1890	12,000	1 Spring, impounded	Gravity	100,000	...	80	0	70	100	100	...	1 Hor. comp. dup Worthington, 750-gal. capacity	750,000	728,000	...	...
20	Newark	21,000	Private	1890	250,000	14 1/2-in. Wells, 32 feet deep; 2 1/2-in. Wells, 21 feet deep; Licking Creek	Pumping to Reservoir	800,000	111	27	0	90	1,653	1,170	780	2	1 Hor. comp. dup Gordon-Maxwell, 2,500-gal. each; 1 Hor. comp. dup Laidlaw-Dunn-Gordon, 2,000-gal.	5,000,000	1,207,880	64	185
21	New Philadelphia	8,231	Private	1886	190,000	18 1/2-in. Wells, 50 feet deep; 6 1/2-in. Wells, 30 feet deep	Pumping to Reservoir	1,350,000	100	13	0	90	600	575	8	2 Hor. dup Blake, 1,000-gal. each; 1 Hor. comp. dup Laidlaw-Dunn-Gordon, 2,000-gal.	4,000,000	600,000	68	175	
22	Orville	2,000	Public	1894	25,000	4 1/2-in. Wells, 114-121 ft. deep	Pumping Direct	...	...	70	0	70	260	260	...	2 Hor. comp. dup Laidlaw-Dunn-Gordon, 1,500-gal. capacity each	3,000,000	141,858	71	91
23	Perryville	500	Public	1894	7,200	1 1/2-in. Well, 93 feet deep	Pumping to Reservoir	54,000	...	75	0	75	100	100	...	1 Smith-Vale, deep well pump, capacity 112,000	112,000	18,000	18	20	
24	Piedmont	275	Private	1894	1,600	2 Springs, impounded	Gravity	12,500	...	55	0	70	80	80	...	...	...	...	...	...
25	Seo	1,000	Private	1899	30,000	2 1/2-in. Wells, 1 1/2-in. Well, 110 feet deep	Pumping to 2 Tanks	95,000	100	4	0	75	30	30	...	2 Hor. dup Laidlaw-Dunn-Gordon, 500-gal. capacity each	1,000,000	31,300	17	150	
26	Shreve	1,115	Public	1893	9,410	1 1/2-in. Well, 142 feet deep	Pumping to Reservoir	80,200	...	80	0	75	80	80	...	1 Laidlaw-Dunn-Gordon deep well, 500-gal. capacity; 1 Hor. dup Miller, 100-gal.	600,000	50,000	27	70	
27	Shelby	1,500	Private	1897	100,000	1 1/2-in. Wells, 66 feet deep	Pumping to Standpipe	212,000	...	100	0	70	300	300	...	2 Hor. comp. dup McGowan, 2,000-gal. each	1,000,000	1,000,000	286	330	
28	Wadsworth	2,000	Private	1891	12,000	1 Spring, impounded	Gravity	56,000	...	30	0	80	223	217	...	1 Hor. comp. Worthington, 150-gal.	150,000	...	...	...
29	Waynesburg	500	Private	1857	1,300	1 1/2-in. Wells, 49 ft. deep	Gravity	10,000	...	20	40	20	30	30	...	...	...	...	...	...
30	Woods	5,500	Public	1878	138,000	Impounded Reservoir 1 1/2 ft. 6 feet deep Apple Creek	Gravity	Imp. Res. 4,000,000	50	11	0	80	167	390	121	1 Hor. comp. Worthington, 750-gal.; 1 Hor. comp. Worthington, 500-gal.; 1 Hor. comp. Apple Creek	1,250,000	500,000	84	210	
31	Zanesville	24,000	Public	1840	300,000	Washington River	Pumping to 2 Reservoirs and to Standpipe	2,000,000	100	10	0	70	1,500	1,500	55	1 Hor. comp. dup Worthington, 2,000-gal.; 1 Hor. comp. dup Holly, 8,000-gal.; 1 Hor. comp. dup Gordon, 2,000-gal.	10,000,000	5,879,443	252	269	
Totals		10,000	22 Public, 1 Private		2,905,440			59,207,900		47,572		21,450	31,416	944		70,814,000	19,605,231				
Number Averaged		41			80			58	29	31	32	31	31	31		29	25	25	25		
Average		6,800			96,840			2,116,714		16	13	70	82	401	9	2,641,874	767,969	76	141		

1 Not used for 4 months past year.

2 Not well supply water was

3 Pumping water, 100,000 gal. supply for

4 Not at all, 100,000 gal. supply for the

5 Not at all, 100,000 gal. supply for the

6 Not at all, 100,000 gal. supply for the

7 Pumping water, 100,000 gal. supply for

8 Pumping water, 100,000 gal. supply for

9 Pumping water, 100,000 gal. supply for

10 Pumping water, 100,000 gal. supply for

11 Not at all

has cost to date \$1,300. The water is obtained by impounding the run-off of two springs located in the upper part of the village and supplying the same to mains by gravity. The reservoir consists of a basin 16 by 33 feet and five feet deep, built of brick and covered with a board roof. It has a capacity of about 16,000 gallons and is located at such a height as to give an average pressure of about 20 pounds. The springs emerge from the side of a hill, which is used as a pasture. One of the springs comes from an abandoned coal bank. There are 0.46 miles of mains in, giving 50 per cent. of the people access to the water. There are 36 services in, all of which are in use and none metered. It was impossible to even estimate the average daily consumption.

SUMMARY.

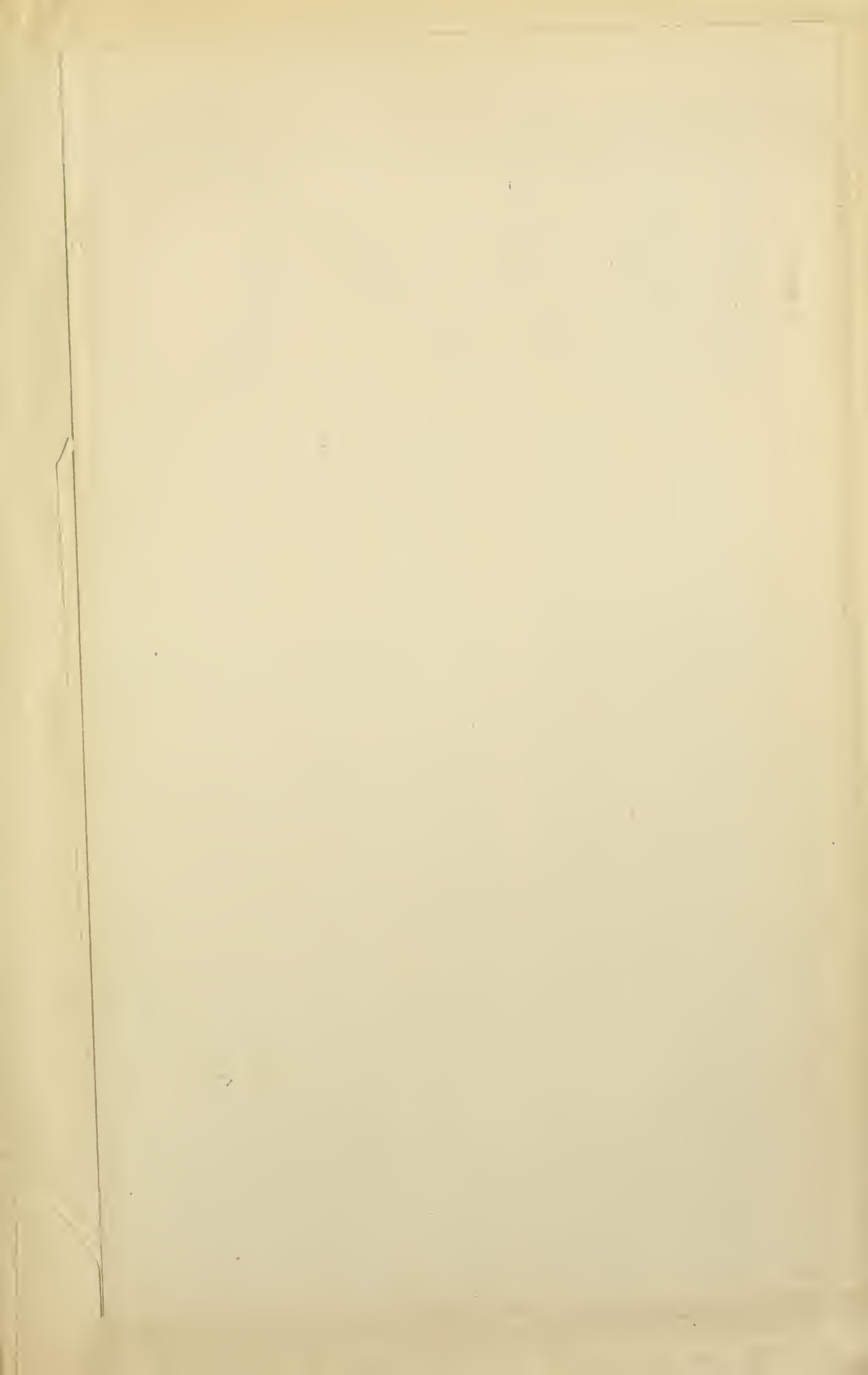
The data contained in the previous section, and also those in reference to those supplies which were reported upon in the last report, have been summarized in the following table:

This table is intended to give a brief description of every public water supply in the Muskingum watershed, and to give it in such a manner as to be easily accessible. In all there are thirty-one public waterworks supplying thirty-two cities and villages, which have a total population of 210,889, or an average per supply of 6,867, or per town 6,590. Twenty-two of the water supplies are owned and operated by the cities and villages themselves, while nine are under the control of private companies. The rapid increase of the number of towns supplied with waterworks is shown by the next column, seventeen of the supplies having been put in since 1890, twenty-five since 1880, twenty-six since 1870, and only five before that time, one as early as 1840.

The total cost to date of thirty of the plants was \$2,905,446, or an average for each of \$96,848. These figures given for the cost to date are supposed to include the original cost of the plant complete and also the cost of all extensions, but not anything for maintenance or repairs. It is interesting to note that Mansfield has the most expensive system, probably as the result of its extended search for a sufficient quantity of ground water. Also Canton, the Dennison Water Supply Company, the Newark Water Supply Company, and Zanesville have spent a great deal of money on their plants with but indifferent success in two cases at least. The different sources have already been discussed.

Pressure is supplied in four cases by pumping direct, in three by gravity, in ten by pumping to a standpipe, in nine by pumping to reservoirs, in three by pumping to a reservoir and by gravity, and in one case each by pumping to reservoirs and standpipes and by pumping to a standpipe and by gravity. The smallness of the number of plants supplied by direct pumping is probably due to the ease with which reservoirs and standpipes can be built on account of the many high hills in the neighborhood of most of the towns. In four cases it was found sufficient to place a small tank on a suitable hill, while none of the standpipes are high. The combined capacities of the various reservoirs and tanks is 59,267,990 gallons, a little more than one-half of which is due to the large storage reservoir on the Massillon gravity supply. The domestic pressure in the different places varies between wide limits, 20 to 125 pounds, the average being 76.6 pounds. The columns giving the number of miles of mains and the percentages of the total population accessible to them show that in general the mains have been pretty well extended and that in most cases practically the whole town has access to the public water. Where there is a wide discrepancy between the number of services in and the number in use it is usually due to the fact that a number of streets are being paved and all the services necessary were taken to the curb so as to avoid tearing up the pavements.

The number of services metered is lamentably small, only two towns in the thirty-one making any attempt to meter every service, and but



seven even trying to meter large consumers. In Shreve and Cambridge every service is supposed to be metered. The effect of this on the consumption is not brought out in Cambridge as several mills use an enormous amount of water there, and besides the water is so muddy that every one lets it run, vainly hoping for it to become clear.

As a rule the pumps of the various plants are in good condition and are working very well, but in a few cases neglect and gritty water have used them up pretty badly. The total capacity of the plants is 17,884,000 gallons, or 2,649,800 gallons for each plant using pumps, or 2,446,450 for each including the two supplied entirely by gravity.

The average daily consumption for twenty-five of the supplies, or all in which it was possible to obtain an estimate, was 787,809 gallons, which is an average of 78 gallons per capita of the total population of each village, and an average of 141 gallons for each consumer. The abnormal consumptions in Cambridge, Dennison and Uhrichsville, and Zanesville are due to the use of large amounts of water for industrial purposes; in Shelby, as has been stated, it is to the use of the water in constructing and flushing of sewers, and in Wooster, probably to the general poor quality of the water.

In ten towns detailed information could be obtained of the consumption for one or more years and this has been worked up in the following table.

In this table there are given the monthly consumptions of ten towns for such periods as accurate figures could be obtained. All the quantities are based upon the discharge of pumps and the principal error is due to inaccuracy in the percentage of slip allowed. This factor was determined by the pumping engineer in nearly every case, and where not so determined ten per cent was allowed as many of the pumps are not kept carefully packed and the valves are left in until they become very badly worn.

In the columns to the right of the body of the table there are summed up the total consumption for all the years available, then the monthly and daily averages and the average daily consumption per capita for both the total population and for the population actually supplied. This was done to show the general increase in the number of consumers, and the amount of water pumped, also the increase for each consumer. Owing to the fact that in but a few cases was it possible to secure the data for more than one or two years, the last statement is not clearly demonstrated in every case; it is shown nicely however in the cases of Massillon, Mt. Vernon, Newark, and Zanesville. Canal Dover, Canton, and Orrville show fluctuations, which with the meager data at hand cannot be accounted for. Mt. Vernon also shows fluctuations, but the long term of years given, shows that they were temporary and that the consumption increases in the end.

Some of the increase in the average daily consumption per consumer is due to the more general introduction of baths and water closets, but much of it must be charged to the extravagance in the use of, and to waste of water which has been brought on by the great abundance with which it has been supplied. The efforts of the authorities have nearly always been for more water and not always for good water, instead of toward caring for and protecting the supply at hand. It is not intended to decry the legitimate use of the water necessary for health, comfort, or even luxury, but only the useless waste of water which compels the expenditure of all the energy of those in charge in the seeking of a sufficient quantity of water and leaves none to be expended on the protection and betterment of the present supply.

The results obtained at the bottom of the table are of more value, also better substantiated as all the figures shown in the table were used in their derivation. They show, within the limits of the table, the average monthly variation in the consumption of water by the various cities and villages, and it is intended to extend the table from year to year, adding new supplies, and getting the figures for the ones used, for a longer term of years, until reliable information is obtained of the amount of water necessary for the supply of any town for each month and hence the maximum amount, and when this maximum amount occurs. Besides the hoped for value of such a table to the engineering profession, it is valuable



TABLE X—WATER RATES FOR PUBLIC WATER SUPPLIES

* Data not sufficient to estimate

Average for 7 Private Works: \$22.76

Average for 13 Public Works \$17.94

in this work of estimating the average daily consumption for a year when only data for a short period are available

The consumption starts out in January nearly five per cent above the mean on account of the waste of water to prevent the freezing of pipes, then gradually decreases with warm weather until May is reached and the sprinkling season commences, then there is an increase until it gets above the mean in June where it remains until November only to start up again with the increasing cold weather.

In the former reports on the public water supplies, brief notes on the water rates were given with the description of each plant. This method allowed but the merest mention of the rate charged and took up a great deal of room uselessly. In Table 10 an attempt has been made to give rather complete information concerning both the flat and meter rates and in much better form than was formerly presented.

In the last column there is given the rate charged according to the different schedules for the use of the water for the model house as specified at the top of this column. This rate varies from \$10 to \$29, and the average is \$19.64. It is necessary to call attention to the fact that the average for the seven private works is \$4.84 per year higher than the average for the thirteen public works.

As in the case of the water rates, the information concerning the franchises of the private companies was formerly scattered through the body of the report and has now been collected and tabulated.

TABLE XI -FRANCHISES

Number.	Town.	Name of Water-Works Company.	Date of Granting of Franchise.	Duration of Franchise in Years.	Purchasing Clause.
1	Dennison	Dennison Water Supply Co.....	September 5, 1887	20	Village may purchase plant complete any time after 15 years
2	Uhrichsville .	Dennison Water Supply Co.....	March 6, 1887	20	Village may purchase at end of 15 years, only such part of plant that is within the corporate limits of said village
3	Massillon	Massillon Water Supply Co.....	First in 1854. Present one on June 7, 1886	20	City may purchase at the end of 10 and 15 years.....
4	Newark	Newark Water Co	May 4, 1885.	20	City may purchase at any time after 10 years.....
5	New Philadelphia ...	New Philadelphia Water Co.....	June 3, 1886.	15	Village may purchase plant at the end of 10 years.....
6	Piedmont ...	Piedmont Water Supply Co.....	Lease gr'ted 1894	99	Nothing stated
7	Scio	Scio Water Supply Co	February 18, 1899	99	Village may purchase at the expiration of each 5 year period from the completion of the works.....

PRIVATE WATER COMPANIES.

Water Rates.	Kind of Water to be Supplied.	Remarks and Notes.
Fixed by franchise.....	The water shall be taken from filtering galleries and wells adjacent to the Big Stillwater Creek, with direct connection to the creek to be used in cases of emergency	Creek water used direct for many years. Mechanical filter plant for creek water now being installed.
Fixed by franchise.....	A good wholesome water suitable for domestic use; to be taken from Big Stillwater Creek or Tuscarawas River through wells or galleries, with an auxiliary pipe to creek or river for use in cases of emergency.....	Note above remark.
Subject to regulation by the city.....	Water is to be taken from Sippo Lake, led to an impounding reservoir, filtered and pumped to a standpipe.....	A new supply from wells introduced in 1893. Lake supply used only for manufacturing and street sprinkling purposes.
Fixed by franchise....	Water shall be obtained from Berkham Spring or such other source as may be approved by city council. It shall be clear water suitable for culinary and drinking purposes and not detrimental to the health of those who use it.	
Fixed by franchise. Must be as low as the average for Ohio private companies ...	The water shall be from filtering galleries or wells adjacent to the Tuscarawas River	Rates are a trifle above those for private companies of Muskingum watershed.
Not regulated	Not specified	Village not incorporated. Springs and right of way leased from County Commissioners. Fire protection furnished free.
Franchise requires same rates as those in use at Bridgeport, Ohio.	The water shall be the best available from driven wells.....	Plant designed and hurried through for fire protection on account of oil boom.

TABLE XI — FRANCHISES PRIVATE

Number.	Town.	Name of Water-Works Company.	Date of Granting of Franchise.	Duration of Franchise in Years.	Purchasing Clause.
8	Shelby	Shelby Water Co.	February 5, 1896	20	Village may purchase at the end of 10 and 15 years.....
9	Wadsworth .	Wadsworth Water Works Co..	September 20, 1881..	Not stat.	First grant allowed village to purchase at end of 10 years: this was amended July 6, 1892, and right relinquished forever
10	Waynesburg .	Waynesburg Water Co	Use of str'ts granted, 1857	Not stat.	Nothing stated

WATER COMPANIES—Concluded.

Water Rates.	Kind of Water to be Supplied.	Remarks and Notes.
Fixed by franchise....	It shall be good potable water free from all obnoxious and injurious elements and be procured from such suitable place as will guarantee its purity and the source shall be protected from future encroachments and pollution. Surface water shall not be used.	
Fixed by franchise....	Not specified	Practically a perpetual franchise.
Not regulated	Not specified	Use of streets granted for free watering troughs and one fire plug.

In this table there is given all the information concerning the franchises granted by the ten cities and villages to the nine private water companies supplying them with water which has any bearing on the data of granting and duration of the franchise, on the time when the plant may be purchased by the city, on the control of the water rates, and on the kind of water to be supplied.

Dennison, Uhrichsville, Massillon, Newark, New Philadelphia, and Shelby have granted their respective companies ordinary short time franchises which state definitely when the municipality may purchase the plant, fix the rates, and these contain at least an attempt to specify the kind of water to be supplied.

As Piedmont is not incorporated, the Piedmont Company secured a 99-year lease from the County Commissioners for the springs and right of way, and supplies water to the village without any regulations whatever. For the use of the streets the company has given free fire protection, something very unusual.

Scio has also given a 99-year franchise, but it includes a purchasing clause, fixes the rates, and specifies in part the kind of water to be supplied.

Wadsworth has practically granted a perpetual franchise and has given up all right of purchasing the plant. For the protection of the village the rates are fixed, but nothing is said regarding the kind of water to be furnished.

Waynesburg has granted a local company the use of the streets for laying mains and supplying water without any regulations or restrictions whatever.

The franchise granted the Dennison Water Supply Company by the village of Uhrichsville is probably the most complete and exact in its requirements, though some of these may not be for the best interests of the villages.

All the franchises are lame in the requirements in reference to the kind of water to be supplied. If anything is given it usually consists of a statement that good, wholesome water is to be provided without saying who shall be judge of the wholesomeness. Since the law requiring the approval of public water supplies by the State Board of Health has been passed, it would be an easy way out of the dilemma to require that the water shall be maintained in a condition of purity satisfactory to the said Board.

TALLI NI - LAMS AND WATER-POWER

VII. DAMS AND WATER POWER.

The traveler through the Muskingum valley cannot help but be impressed by the desolateness of one feature of the landscape, namely, the old water-power grist and saw mills. On every hand through this section there is to be found the ruins of some once busy mill with its race now clogged up and its dam broken out. During the height of this method of obtaining power, many small streams in the hilly section had their flow utilized every mile or so by a small mill, which either ground flour and meal for the farmers and feed for their cattle, sawed up the timber for buildings and fences, or perhaps only furnished power enough to run a small cider press, though the latter was usually an adjunct of the grist or saw mills. Occasionally the water-power was utilized for running a small woolen mill, machine or turning shop.

With the decline of the canal system from the reduction of the water supply and from the competition of the railroads, came the decline of the water-powers, some from the lack of transportation facilities, but principally from the lack of water and from the cheapening of coal. It soon became unprofitable to tie up capital in a water-power mill which could run but a few months in the year. The life of many of these water-powers was prolonged by the introduction of auxiliary steam plants, in fact, nearly every important water-power in this district is so provided, except those powers located on the canal system or on the slack water navigation of the Muskingum River.

The following table has been prepared to show the number and character of the dams still in and the nature and amount of water power derived from them, and also from the canal system.

The data for this table were collected during the sanitary survey of the watershed and nearly all of them are from personal inspections of and visits to each of the powers and dams named; in a few instances only were the reports of other persons taken, and these in but unimportant cases. The information was secured in nearly every case from the mill owners and is as accurate as it is possible to obtain without actually measuring and rating the dams and wheels. The data in reference to the dams and their back water could be obtained by actual measurements in but few cases, and so much of it is only approximately correct as many of the owners have but little knowledge on this subject. Where given, the data in reference to the head and water wheels are probably very nearly correct; the horse-power is probably too high if anything. The areas given for the tributary watersheds were obtained by planimeter measurements of a watershed map and are approximately correct.

The dams and water-powers are placed in the table in the same order that the sources of pollution were taken up, that is, beginning at Marietta and bringing in each subsidiary watershed and tributary in its proper place. The table shows 90 water-powers as against 253, which were reported by Hon. Dwight Porter in the 10th census, as in existence in 1880. Owing to the large area covered in this work it is very probable that a few unimportant powers have been overlooked, but the number cannot be great as special inquiry was made on this subject in order to locate all the dams.

Considering the large number of powers that have been abandoned in the last 20 years this reduction of 65 per cent. is not so hard to believe. All through this district there are many streams which but a few years ago supported seven or eight powers and now but one or two, if any. This decline in the number of water-powers is brought out in another light by the following: In 1880 the total horse-power given was 7,066, while in Table 12 there is listed 3,960, a falling off of only 44 per cent. This is due to some extent to the fact that it is but the small powers that escaped notice this year, but principally to the fact that it is the small powers located on the small streams that have been first to suffer from the lack of uniformity in the flow of the streams. Many of the creeks which formerly maintained a good flow the year around are now dry in summer and fall and at flood height during short periods in the winter and spring, thus leaving but a few months in the latter seasons during which power may be obtained.

There are 84 dams described, eight of which are not in use at all; 10 were built for the slack water navigation of the Muskingum, four for canal feeders, and the remaining 62 were put in for power purposes alone. There is a small dam in the Tuscarawas river near its headwaters to divert the same to the canal reservoirs and feeders, and there is a waste way in the same river where the canal crosses it above Clinton,

which, together with several small temporary dams, have not been given in the table.

All the dams given in the table as in *poor* condition have not been repaired for years and the mills near them are usually in the same state. The next ten years will find nearly all of these out and gone if the present conditions hold. In many cases it seems as if the mill owners were merely hanging on until the dam went out or the mill fell down, no attempt being made to keep up the repairs. The mills marked as being *little used*, corresponding in nearly every case with a poor dam, are in poor condition, many being practically abandoned. It will be noted, however, that not in every case does a poor mill go with a poor dam or vice versa.

Another source of failure of the water-powers has been the silting up of the back-waters of the old dams in some cases to such an extent as to cut down the storage capacity to almost nothing. This state of affairs makes it impossible to obtain any power except while the stream is actually flowing the amount necessary, so that many powers which were formerly good for eight or nine months can now be counted on for but half that amount and even less, especially if the stream was so small that the night flows had to be stored for use in the day time.

The best power in the watershed is obtained from the canal system and from the slack water navigation system in the lower part of the Muskingum river. The water-powers at Adams Mills, Newcomerstown, Port Washington, Lock Seventeen, and Blakes Mills are on the Ohio Canal proper and utilize the fall at a lock, or in the case of Adams Mills, at a double lock. The water supply for these mills is sufficient nearly all the time to run the mill at its full capacity, in fact the decline of navigation has almost increased the amount of water to be had at the mills as none is now lost in lockages. At times during the winter ice blocks the canal and cuts off the supply for a short time, but the water seldom fails in summer from drought.

The mill at Dresden is located on the Dresden Side Cut and obtains its head from the fall between the canal and the Muskingum River. This side cut carries off much of the surplus water of the canal between the Licking and the Portage summits, and could furnish an excellent power if it were developed.

Two of the mills at Roscoe use the water from the Walhonding feeder as it passes to the canal proper and two take water from the canal and send it to Walhonding Creek. These powers are of great value and much more could be obtained from them by proper development.

The power on the Kirkersville feeder is of but little importance and can be developed but little as the area draining to the feeder is too small to insure a steady supply.

The power at Canal Dover on the Sugar Creek feeder should have plenty of water, but the works have been neglected and are now in poor

condition. This mill uses water as it passes from the feeder to the canal and wastes none, but at the same point is a mill which takes the water from the canal and sends it to the Tuscarawas River. Both of the above powers were granted to the owners in payment for the diversion of the water of Sugar Creek for the use of the canal.

At the old town of Zoar there is a combination of water-powers, listed as one in the table, which use water from the Zoar feeder dam and send it back to the river. These were also granted in payment to former water-right owners for the diversion of part of the flow of the Tuscarawas to the canal.

The 14 water-powers now in use at eight government dams as shown in the table, were granted when the supply was plentiful for the sake of increasing the industries along the river, and thus the amount of navigation on the slack water system which was then, however, not under government control. Now the water supply is not sufficient for navigation and these powers also, and their use, is discouraged. Most of the leases were for long periods and at low rates and are very valuable concessions, especially the one at McConnellsville, where, in payment for a previous water-right, the present owners have a perpetual lease on the site and must be furnished free about 17,000 cubic feet of water per minute at a head of 11 feet. The lease says, "enough water for 10 run of 4 foot 5 inch stones."

Of the powers derived from dams built for this purpose alone the following are the best: At Zanesville on Licking Creek, at Killbuck on Killbuck Creek, at Gambier and Mt. Vernon on the Kokosing River, at Brinkhaven on the Mohican, at Loudonville on the Black Fork of the Mohican, at Magnolia on Sandy Creek, and at New Philadelphia on the Tuscarawas River. This last named plant is fitted with modern wheels well put in and is a first class power for the time for which it can be used. Most of the failure of this power is due to back-water during freshets and floods and not so much to the lack of water in the dry season. The horse-power claimed here is probably too high, though a 350 horse-power auxiliary steam plant is used when the water power fails.

It was noticed in the interviews with many of the mill owners that their water-powers were for sale and at a low figure; in the future some of these plants may furnish a profitable field for the investment of capital.

AA. STREAM GAGING.

In connection with the United States Geological Survey the State Board of Health has established gages for the reading of the daily height of the streams at Mexico and Fremont on the Sandusky River, at Waterville on the Maumee, and two at Columbus for the Scioto and Olentangy rivers. Sufficient work has not been done on the Sandusky and Maumee rivers to make use of the daily river heights and the results for these two streams will be published later.

Following are the results for the Scioto and Olentangy rivers, and also approximate figures on the flow of the Muskingum River at Eagleport.

SCIOTO RIVER (ABOVE COLUMBUS) AND OLENTANGY RIVER.

The results for these two streams have been made available this year through the co-operation of the Ohio State University. As on the other streams the daily stream heights were read by persons in the employ of the Ohio State Board of Health, but all the field work was done by the students of the University under the direction of Prof. C. N. Brown, of the department of civil engineering. In 1898 and 1899 the work was carried on by D. W. Smith and C. M. Sprague, and in 1899 and 1900 by H. W. Boden and F. K. Pratt.

The river heights are read twice each day. Meter gagings are frequently made of the streams and a curve plotted showing the discharge of the streams at the various heights. From this discharge curve and from the daily record of the river heights the flow of the stream in cubic feet per second for each day is obtained. From these figures representing the average daily discharge, the total discharge for each day and hence for the year is obtained. The gaging has been done with great care and the results are in full accord with the present engineering standards for this class of work.

The rainfall over the watersheds tributary to these streams was obtained from the monthly reports of the Weather Bureau. The readings for all the stations in the watersheds and for those near the same are taken and the isohyets, or curves of equal rainfall, plotted on a map, then the areas of equal rainfall are measured by a planimeter and the total amount of rainfall secured. This is a more accurate method of obtaining this figure than by a mere averaging of the rainfall at each station and gives the work a greater value.

The areas of the watershed were obtained from the State Board of Health map of Ohio and are as follows: Scioto (above Columbus) 1047 square miles, Olentangy 514 square miles.

The Scioto and Olentangy basins are located side by side and occupy a small section of the central part of the State. The Scioto basin lies to the west of the Olentangy and is Y shaped in outline, the main streams turning off to the west with a large tributary reaching to the north-west. The Olentangy basin consists of a long narrow stream, the main stream having but few tributaries and none of these large. Both of these watersheds are fairly level, being entirely within the glaciated area of the State, and showing the outcrop of the native rock in but few sections. The timber has been well cleaned out, as the district is distinctly an agricultural one.

Table 13, following, shows the monthly rainfall at the 18 stations used, also the estimated equivalent rainfall for the two watersheds as determined by the method mentioned above.

TABLE XIII — MONTHLY RAINFALL, 1898-99. SCIOTO AND OLENTANGY WATERSHED.

Place.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total 1899.
Upper Sandusky	3.14	3.20	2.44	4.48	1.14	5.96	2.55	6.08	2.67	1.30	2.16	1.95	8.60	37.53
Bucyrus	1.25	3.40	1.91	4.16	1.33	5.71	2.95	5.01	0.40	2.62	2.32	2.10	8.42	35.33
Kenton	3.04	3.46	2.11	4.90	1.21	4.65	1.05	3.28	2.25	1.32	2.05	3.04	2.93	32.25
Marion	1.65	2.97	1.68	4.71	1.45	3.05	2.42	4.73	3.47	1.39	1.79	2.29	3.02	33.07
Bangorville	2.95	3.69	1.64	4.38	1.01	4.38	6.33	5.45	2.43	3.24	2.59	1.98	2.98	40.10
Levering	2.63	3.84	1.50	4.86	1.08	4.45	6.05	6.45	3.97	3.22	2.37	2.19	2.98	40.10
Bellefontaine .....	.....	.....	.....	4.50	0.87	2.47	1.09	5.46	1.15	1.23	1.87	1.72	2.23	.....
Richwood	2.59	3.48	1.93	4.75	0.99	2.08	1.54	6.23	2.10	1.31	1.91	1.77	3.46	31.55
Delaware	1.82	3.02	1.61	4.50	0.99	2.95	2.85	5.45	2.70	1.85	2.61	1.80	2.90	33.23
Millfordton	2.52	2.93	1.97	4.52	1.25	3.74	2.55	3.87	1.45	2.54	2.44	1.37	2.78	31.41
Urbana	2.42	2.90	1.06	4.19	1.07	3.75	1.04	5.12	0.55	1.83	2.38	1.28	2.46	26.73
North Lewisburg	2.45	3.75	2.05	4.75	1.35	4.20	1.15	6.35	0.75	2.10	2.30	1.70	3.55	34.00
Westerville	2.34	3.05	1.32	4.11	1.11	4.67	2.81	4.88	2.41	1.90	2.85	1.56	3.01	33.08
Plattsburg	2.87	3.61	1.86	4.63	1.53	1.83	1.58	3.48	0.15	1.37	2.07	1.05	2.90	26.06
Columbus	1.09	2.35	1.44	4.69	1.18	2.25	1.26	4.85	1.49	2.01	2.23	1.72	2.98	28.45
Ohio State University	3.07	2.86	1.40	4.58	1.21	3.35	2.05	4.86	1.11	1.38	2.15	1.74	3.42	29.11
Paraskala	3.44	2.39	1.97	5.38	2.15	3.40	7.68	4.83	1.16	2.43	2.44	1.68	3.10	38.61
Granville	3.58	2.41	1.84	5.40	2.44	3.15	4.72	5.47	1.95	2.62	1.94	1.99	3.19	37.12
Equivalent for Scioto	2.48	3.42	1.91	4.73	1.16	3.36	1.68	5.13	2.09	1.55	2.14	2.10	3.10	32.37
Equivalent for Olentangy	1.99	3.24	1.66	4.53	1.20	3.80	3.22	5.42	2.66	2.07	2.30	2.05	3.35	35.50

The discharge of the streams is given in Tables 14 and 15, which are made up according to the methods of the United States Geological Survey, with the addition of the rainfall and the ratio of run-off.

TABLE XIV—MONTHLY DISCHARGE OF SCIOTO RIVER AT COLUMBUS.

DRAINAGE AREA—1,047 SQUARE MILES.

Month 1898-9.	Discharge in second feet.			Total in acre— feet.	Run-off.			
	Maximum.	Minimum.	Mean.		Second feet per square mile.	Depth in inches.	Rainfall in inches.	Ratio.
December .	7,425	60	1,149	70,631	1.097	1.27	2.48	0.510
January ...	16,110	510	3,143	193,257	3.002	3.47	3.42	1.012
February..	4,825	130	850	47,207	0.812	0.85	1.91	0.443
March....	6,920	935	3,263	200,628	3.116	3.60	4.73	0.760
April.....	1,425	170	783	46,571	0.748	0.84	1.16	0.717
May. . . .	215	100	153	9,411	0.146	0.17	3.36	0.050
June	720	13	146	8,697	0.14	0.156	1.68	0.093
July.....	430	05	117	7,166	0.11	0.129	5.13	0.025
August....	1,975	09	205	12,593	0.20	0.226	2.09	0.108
September.	13	05	9	559	0.01	0.010	1.55	0.006
October ...	59	09	18	1,125	0.02	0.020	2.14	0.009
November.	75	17	38	2,281	0.04	0.040	2.10	0.019
December .	1,110	35	278	17,115	0.27	0.307	3.10	0.099
1899.....	16,110	05	755	546,614	0.72	9.818	32.37	0.300

TABLE XV—DISCHARGE OF OLENTANGY RIVER AT COLUMBUS.

DRAINAGE AREA—514 SQUARE MILES.

Month 1898-9.	Discharge in second feet.			Total in acre — feet.	Run-off.			
	Maximum.	Minimum.	Mean.		Second feet per square mile.	Depth in inches.	Rainfall in inches.	Ratio.
December .	5,670	48	744	45,760	1.447	1.67	1.99	0.839
January ...	10,180	230	1,686	103,674	3.280	3.80	3.24	1.166
February...	2,660	230	574	31,870	1.117	1.16	1.66	0.700
March.....	4,500	412	1,554	95,573	3.023	3.49	4.53	0.770
April.....	2,370	90	397	23,649	0.772	0.86	1.20	0.718
May.....	465	36	111	6,793	0.216	0.25	3.80	0.065
June	1,412	55	290.7	17,296	0.565	0.631	3.22	0.197
July.....	222	25	70.9	4,360	0.138	0.159	5.42	0.029
August...	1,520	25	159.1	9,780	0.309	0.357	2.66	0.135
September.	25	8	13.1	780	0.025	0.023	2.07	0.014
October...	25	8	9.8	603	0.019	0.022	2.30	0.010
November.	55	25	47.8	2,844	0.093	0.104	2.05	0.051
December .	1,740	25	310.7	19,103	0.604	0.697	3.35	0.230
1899.	10,180	8	438	316,325	0.852	11.565	35.50	0.326

The daily discharge is shown graphically in Plates 18 and 19.

Plate 18

Discharge of Scioto River at Columbus, O., 1898-9.

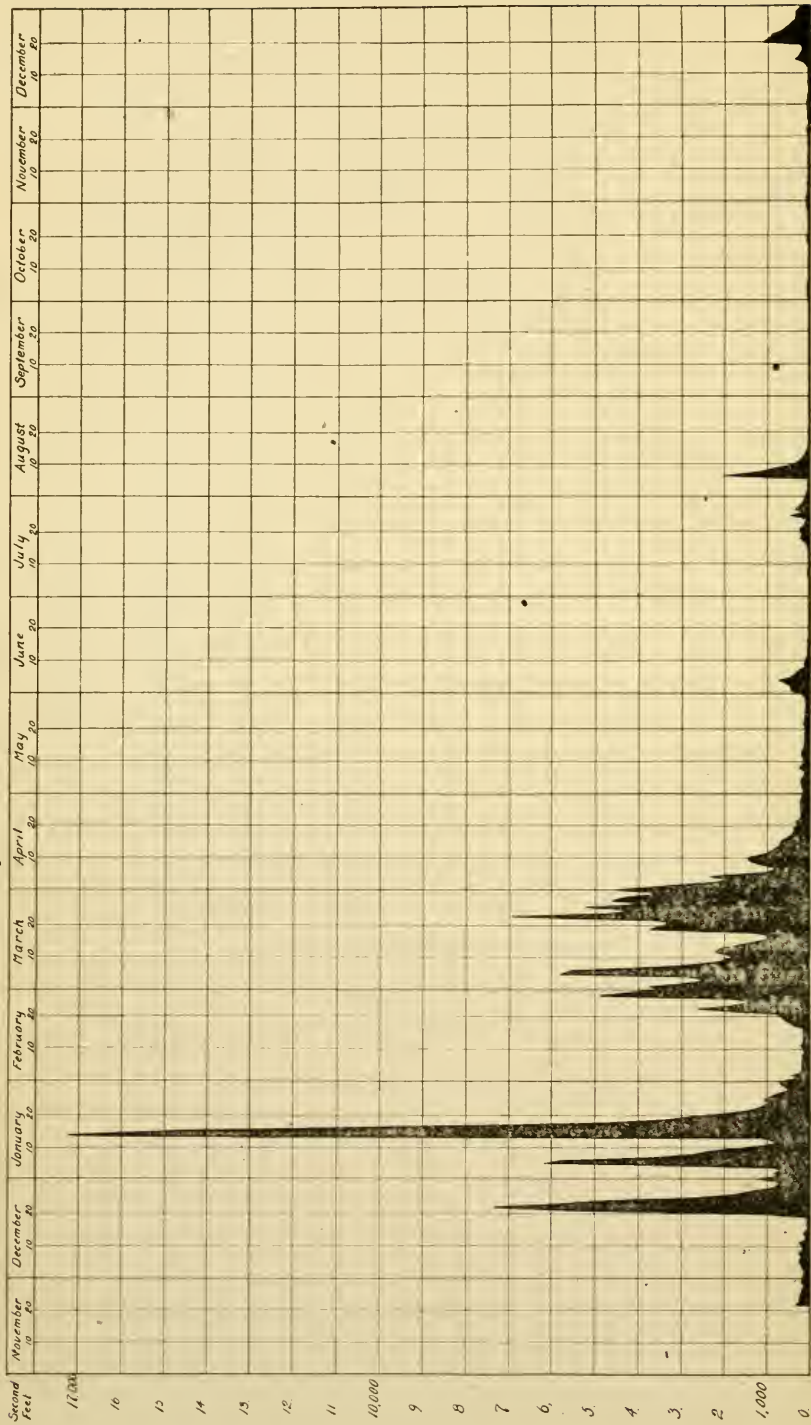
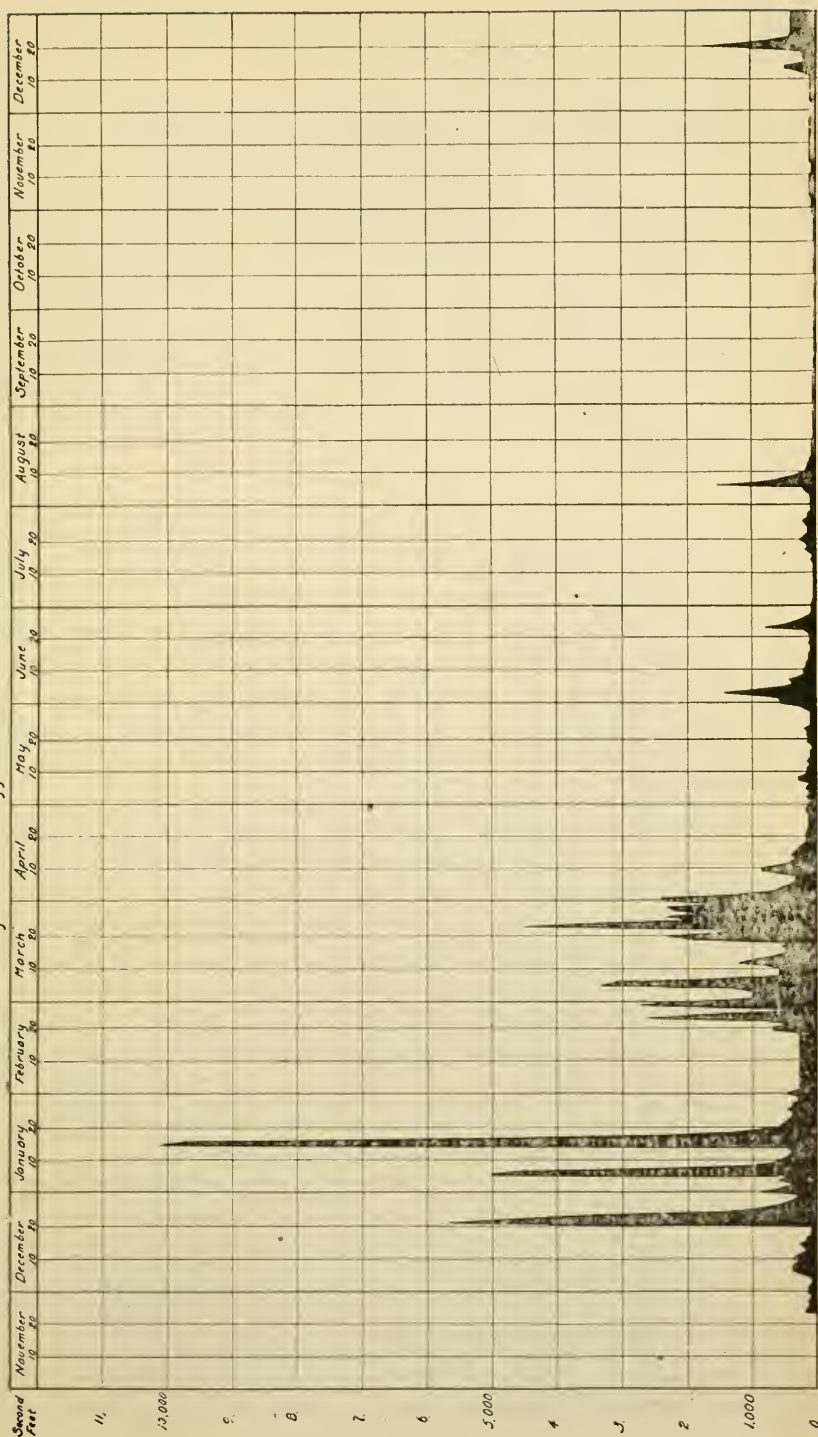


Plate 19

Discharge of Olentangy River at Columbus, O., 1898-9



The discharges of the two streams bear close resemblance to each other as would be expected from their proximity and the similarity of the topography of their watersheds.

The percentage of run-off is almost exactly the same and its distribution through the year is very similar. It is interesting to note that in the month of January for both streams the run-off was in excess of the rainfall. This was due to the melting of snow which fell in December and to the fact that the ground was frozen over and rendered impervious so that practically all the rainfall could run off. From May until the end of the year the run-off represented a small per cent of the rainfall, especially in September and October. In general the year was marked by low flows due not so much to a decrease in rainfall as to the lack of long periods of continuous rain. The rainfall was as a rule scattered, so that much of it soaked into the ground to be evaporated or used by vegetation.

MUSKINGUM RIVER.

The accurate gaging of this stream with a reasonable expenditure of time and money is an extremely difficult matter. Below Zanesville slack water navigation is maintained by 10 fixed dams. Boats are locked through these from pool to pool, or level to level as in a canal system. This effectually cuts off the use of a current meter on the main portion of the river and makes it necessary to go to the tributaries for such work. To carry out such a program would mean the maintenance of hundreds of gages and the making of an innumerable number of meter measurements to make use of these readings.

Deprived of this method, the next best was investigated, namely, the use of one of the numerous dams as a weir. The selection of a dam was determined by the location, accessibility, age and condition, and style, the condition of the locks and whether water power was supplied or not. Considering everything it was decided that Dam No. 8 at Eagleport would give the best results. The pool levels above and below the dam are read from two to four times daily by the lock-keeper and a record of the number of lockages is also kept by the same person. These data were kindly furnished by Mr. Edmund Moeser, U. S. Resident Engineer, Zanesville, Ohio, together with plans and other valuable information for which the Board is greatly indebted.

A formula for the flow over this dam was obtained through the United States Geological Survey from the Rafter experiments at Cornell University. The dam selected was found to have sunken for a portion of its length and the crest lowered some three to five inches. Owing to high water it was impossible to survey the crest and the effect of this lowered crest was estimated for the low stages of the river from the water powers both above and below the dam and the corrections made to the discharge for all stages.

It is regretted that the results following are not more accurate but it was impossible to obtain better at this time and they are given for what they are worth.

TABLE XVI—ESTIMATED MONTHLY DISCHARGE OF THE MUSKINGUM RIVER AT EAGLEPORT, FOR 1899.

DRAINAGE AREA—6,849 SQUARE MILES.

Month 1899.	Discharge in second feet.			Total in acre—feet.	Run-off.		
	Maximum.	Minimum.	Mean.		Depth in inches.	Second feet per square mile.	Mean rainfall.
January.....	31,590	2,670	11,466	705,008	1.93	1.67	2.61
February.....	14,970	720	5,137	341,368	.78	.75	1.83
March.....	26,530	5,640	15,898	978,546	2.68	2.32	4.52
April.....	22,570	2,530	7,146	425,213	1.16	1.04	1.81
May.....	12,020	1,060	2,789	171,501	.47	.41	4.76
June.....	12,370	720	3,945	234,742	.64	.58	4.00
July.....	3,520	251	960	59,007	.16	.14	4.35
August.....	3,500	171	709	43,612	.12	.10	1.47
September.....	194	171	175	10,483	.03	.03	3.30
October.....	348	171	181	11,141	.03	.03	2.12
November.....	476	194	322	19,183	.05	.05	1.60
December.....	11,120	220	2,711	166,724	.46	.40	3.05
The year.....	31,590	171	4,286	3,166,528	8.51	.627	35.42

The mean monthly rainfall as shown in the last column was obtained from Table 17, the data for which was obtained from the reports of the U. S. Weather Bureau.

Plate 20

Estimated Discharge of Mustangum River at Eagleport, O. 1899.

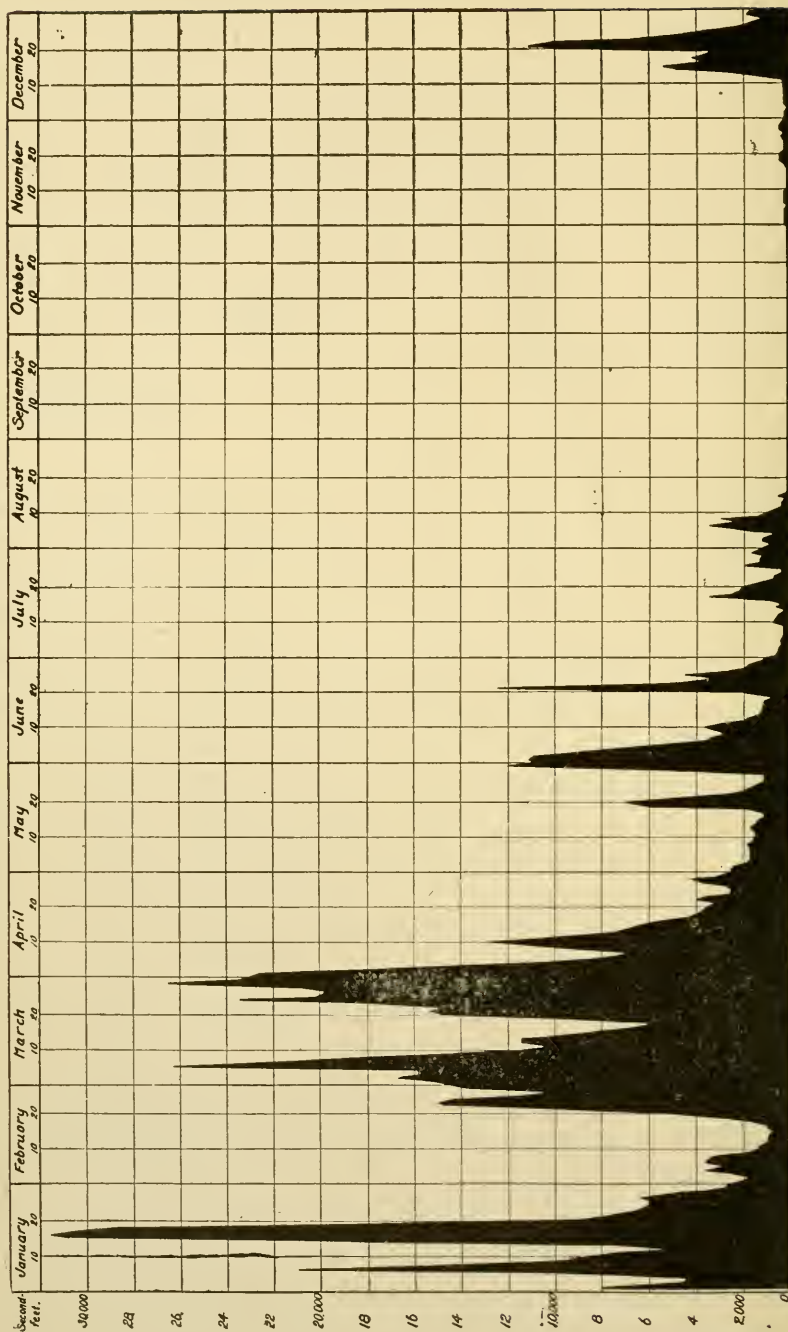


TABLE XVII — RAINFALL FOR 1899 ON MUSKINGUM WATERSHED.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Ashland	2.16	1.24	2.71	0.69	4.50	3.67	3.92	1.13	3.13	2.63	1.71	3.10	30.59
Bangorville	3.68	1.64	4.38	1.01	4.38	6.33	5.45	2.43	3.24	2.59	1.98	2.98	40.09
Canton	2.12	1.72	4.86	4.45	5.52	2.85	4.69	1.14	3.26	1.83	2.14	3.56	38.15
Green Hill	1.88	1.72	3.58	2.41	6.04	3.20	5.19	1.38	3.43	1.88	1.51	3.36	35.58
Wooster	3.29	1.64	3.95	1.28	4.42	1.95	3.73	0.53	5.56	2.21	1.59	2.78	32.93
Cambridge	2.17	2.05	4.59	1.36	4.55	4.76	4.66	1.05	2.60	2.21	1.44	3.17	34.61
Canal Dover	3.28	2.18	4.53	2.17	6.84	2.89	3.53	1.28	3.61	1.65	1.90	3.59	37.45
Carrollton	2.13	2.54	4.17	2.69	5.92	3.92	4.15	1.06	.....	.....	.....	.....	.....
Granville	2.41	1.84	5.60	2.44	3.15	4.72	5.47	1.95	2.62	.....	1.99	3.19	.....
Gratiot	2.53	2.21	5.48	1.67	3.53	4.12	3.64	1.16	2.59	1.74	1.41	3.08	33.16
Millfordon	2.93	1.98	4.52	1.25	3.71	2.55	3.87	1.45	2.54	2.44	1.37	2.78	31.42
Killbuck	3.15	0.89	4.51	1.35	4.74	2.82	3.20	0.82	3.23	1.81	1.25	2.38	30.15
Pataskala	2.39	1.97	5.38	2.15	3.40	7.68	4.83	1.16	2.43	2.44	1.68	3.10	38.61
Philo	2.03	2.16	4.55	0.96	4.45	5.08	4.71	1.39	4.37	2.40	1.10	2.86	36.06
Warsaw	3.06	1.70	5.01	1.22	6.17	3.44	4.27	4.08	3.58	1.76	1.26	2.70	38.25
Total	39.21	27.48	67.82	27.10	71.35	59.98	65.31	22.01	46.19	27.59	22.33	42.63	.....
Mean	2.61	1.83	4.52	1.81	4.76	4.00	4.35	1.47	3.30	2.12	1.60	3.05	35.42

The 15 stations given here are scattered over the whole watershed above Eagleport and the mean of the rainfall at these stations will give a very fair average for the watershed.

It is impossible to make a proper study of the run-off of this watershed as the canal system diverts a portion of the flow of the northern tributaries to the Cuyahoga River and of the south-western tributaries to the Scioto River. From the data at hand it is impossible to state the extent of this diversion and the effect it should have on the run-off, but it should be more noticeable in the low flows than in the higher ones as a larger per cent of the former is used.

This diversion of some of the water and the inaccuracies in the estimates of the flow, make the figures, in Table 13, which relate to run-off of but secondary value, but as they will give an idea of the amount, they are given for what they are worth. It is shown that 8.51 inches of the rainfall or 21.2 per cent ran off.

In 1895 on the survey of the canals of the State by the U. S. Engineering department, estimates were made on the run-off of this river at Zanesville. The average per cent of run-off for 8 years 1888-1895 was 33 or 11.8 per cent above the figure given above. The average for three dry years—1889-1894-1895, was 22 per cent or 0.8 per cent above the estimate for 1899. These comparisons show that the estimates for 1899 are approximately correct.

From the middle of August until the last of October the water never got above the true crest of the dam and the constant flow shown in the chart is due to the flow over the depressed crest, leakage, locking of boats, etc. The methods used in the work would not admit of any great refinement in the estimates of these low flows, so an average figure was estimated for them from the water power rating as mentioned above.

APPENDIX II.

PROCEEDINGS OF THE ANNUAL MEETING

OF THE

STATE BOARD OF HEALTH

AND

LOCAL BOARDS OF HEALTH OF OHIO,

HELD IN

COLUMBUS, O., JANUARY 25TH AND 26TH, 1900.

REPRINTED FROM THE OHIO SANITARY
BULLETIN FOR JANUARY-FEBRUARY, 1900.

.... PROCEEDINGS

OF THE

State and Local Boards of Health of Ohio,

HELD IN

COLUMBUS, JANUARY 25-26, 1900.

DELEGATES IN ATTENDANCE AT THE TENTH ANNUAL
MEETING OF STATE AND LOCAL BOARDS
OF HEALTH.

Dr. W. H. Alexander, Health Officer, Waynesville; John Althouse, Seal; J. W. Arbegast, Xenia; J. Ault, Adelaide; Jerome Ault, Township Health Officer, Caledonia; Charles H. Barnett, Member Township Board of Health, Ashtabula; John L. Barrick, Member Board of Health, Upper Sandusky; H. F. Baty, Lima; Dr. A. J. Baumhardt, Lorain; Amos Beardsley, Health Officer, Findlay; N. C. Beery, Member Township Board of Health, Lima; John Begley, Member Township Board of Health, Addyston; Robert Bell, New Straitsville; E. E. Bennett, Member Board of Health, Mack; Dr. Robert R. Black, Member Board of Health, Galion; Dr. J. A. Blake, Sandusky; T. B. Bowersock, President Board of Health, Allentown; H. H. Bratten, South Brooklyn; N. E. Brenneman, Member Township Board of Health, Elida; Dr. A. A. Brooks, Health Officer, Orrville; Dr. H. S. Brown, Health Officer, Niles; J. S. Brown, Chillicothe; W. F. Brown, Toledo; Dr. W. L. Buechner, Member Board of Health, Youngstown; Hugh Burns, Junction City; C. M. Butt, Clerk Township Board of Health, Plain City; E. W. Busby, Clerk Township Board of Health, Massillon; Oscar Byerly, President Township Board of Health, Lima; C. W. Caine, Clerk Township Board of Health, North Bend; W. N. Caldwell, Health Officer, Fostoria; E. N. Campbell, Clerk Board of Health, Ashtabula; Richard Carter, Tiffin; A. P. Carr, Johnstown; Elza Carter, Upper Sandusky; Dr. J. Robert Caywood, Lockington; Dr. E. E. K. Chapman, Health Officer, Defiance; Dr. W. C. Chapman, Member State Board of Health, Toledo; H. J. Clark, Secretary Board of Health, Oberlin; Dr. W. P. Clay, Health Officer, Mendon; O. F. Clemmer, Clerk Board of Health, Harshman; A. N. Compton, Coshocton; Dr. George R. Conard, Health Officer, New

Vienna; R. R. Conger, Township Health Officer, Cheviot; John Conrad, Township Health Officer, Canton; L. Coplin, Akron; G. W. Cowgill, Member Township Board of Health, Richwood; E. B. Cox, Xenia; Dr. S. S. Cox, Health Officer, Lorain; James D. Coy, Clerk Township Board of Health, East Toledo; J. N. Cremean, Allentown; Dr. J. C. Crossland, Member State Board of Health, Zanesville; J. A. Custer, Clerk Township Board of Health, Lima; Dr. W. A. Daugherty, Health Officer, Bucyrus; Dr. A. D. DeHaven, Health Officer, Xenia; Dr. W. D. Deuschle, Health Officer, Columbus; L. Dellinger, Health Officer, Bloomingburg; Dr. T. J. Dillinger, Health Officer, Murray; Dr. H. A. Dillon, Dayton; J. Dougherty, Bucyrus; J. A. Dunham, Member Board of Health, Mendon; Dr. E. S. Dunn, Secretary Board of Health, Port Washington; F. W. Edison, Lorain; H. W. Elsass, Member Board of Health, Massillon; M. Elsass, Member Township Board of Health, Massillon; Dr. J. B. K. Evans, Health Officer, McGuffey; L. Fiesinger, Member Board of Health, Norwalk; John Fitter, Lima; John Fish, Member Board of Health, Coshocton; Charles E. Fisher, Clerk Township Board of Health, Wapakoneta; D. C. Fisher, Member Board of Health, Lorain; George Flammer, Health Officer, Covington; B. H. Flynn, C. E., Engineer State Board of Health, Columbus; W. H. Flynn, Clerk Township Board of Health, Tiffin; Dr. J. E. Foster, Health Officer, Coshocton; Dr. W. T. Gemmill, Member State Board of Health, Forest; Dr. J. D. Geyer, Member Board of Health, Sidney; W. A. Gold, Member Board of Health, Port Washington; Fred Goodman, Member Township Board of Health, Lima; Dr. P. A. Gordon, Township Health Officer, Junction City; Dr. F. N. Garand, Toledo; Dr. C. A. Grahm, Health Officer, South Charleston; John W. Grimm, Esq., Member Board of Health, Findlay; Otto Grove, Member Township Board of Health, Millersport; Dr. W. C. Gutermuth, Health Officer and Secretary Board of Health, Versailles; H. W. Hague, Wilmington; E. Haines, Canton; A. B. Hang, Louisville; Dr. J. M. Hanley, Health Officer, Chillicothe; John A. Harned, Clerk Township Board of Health, Xenia; George G. Harris, Martinsville; Dr. H. H. Hartman, Health Officer, Galion; Dr. Josiah Hartzell, President State Board of Health, Canton; George Hasselwerth, Defiance; W. C. Hayden, Member Township Board of Health, College Hill; A. W. Hayes, President Township Board of Health, North Bend; Simon Hearn, Member Township Board of Health, Cleves; David Hefner, Member Township Board of Health, Lima; Harrison Hefner, Member Township Board of Health, Lafayette; Dr. Frank W. Hendley, Member General Assembly, Cincinnati; J. W. Hepler, Jr., Defiance; James Hales, Toledo; Dr. C. B. Holcomb, Secretary Board of Health, Corning; E. G. Horton, B. S., Bacteriologist State Board of Health, Columbus; Dr. A. W. Hopkins, Health Officer, Ashtabula; Dr. J. S. Howland, Health Officer, Plain City; M. W. Hoye, Sanitary Policeman and Milk Inspector, Akron; I. L. Hull, Clerk Board of Health, New London; Dr. E. G. Husted, Health

Officer, Beamsville; D. L. Ingard, Upper Sandusky; Charles E. Jarvis, Member Township Board of Health, Massillon; J. W. Johnson, Health Officer, Ashville; T. W. Johnson, V. S., Sidney; J. E. Kaufman, Little York; J. A. Keener, West Salem; H. E. Kingsboro, Member Board of Health, Shelby; Dr. F. E. Kitzmiller, Health Officer, Piqua; L. L. Knoble, Member Board of Health, Galion; Joseph E. Koepfel, Clerk Board of Health, Germantown; A. Kohler, Health Officer, Wapakoneta; J. R. Kramer, President Board of Health, Pleasantville; Dr. F. W. Lane, Health Officer, Fairview; F. S. Latham, Member Township Board of Health, Plain City; Dr. L. F. Laudick, Health Officer, Lima; Noah Lee, Health Officer, Caledonia; Dr. William H. Leet, Health Officer, Conneaut; Dr. George F. Leick, Health Officer, Cleveland; J. W. Linderman, Lima; Dr. O. W. Lindsay, Secretary Board of Health, Columbus; C. W. Linhart, President Board of Health, Xenia; A. L. Lotz, Osnaburg; Dr. E. N. Loy, Health Officer, Troy; Ira E. Lutz, Clerk Township Board of Health, Union; Dr. C. N. Lyman, Health Officer, Wadsworth; J. W. McBride, Sanitary Policeman, Niles; James F. McDanel, Member Board of Health, Ashland; R. A. Mackzum, Member Board of Health, St. Bernard; Dr. R. C. McNeill, Member Board of Health, Belle Center; Dr. E. Martin, Health Officer, Norwalk; Dr. G. O. Maskey, Health Officer, Upper Sandusky; J. C. Meissner, Alderman, Toledo; John D. Merris, Member Board of Health, Upper Sandusky; Dr. C. L. Metz, Health Officer, Madisonville; John H. Meyer, Bucyrus; Dr. F. T. Miles, Health Officer, Salem; E. J. Miller, Clerk Township Board of Health, Stone Creek; Joseph D. Miller, Health Officer, Canton; D. H. Morehead, Junction City; Dr. Charles B. Morrey, Columbus; C. W. Nessler, President Board of Health, Sidney; Daniel Newcomer, Polk; John C. Nieffer, Member Board of Health, Harshman; Mr. I. A. Oldham, Health Officer, Cambridge; J. H. Parmar, Akron; R. B. Pierson, Secretary Board of Health, Pataskala; Adam Pontious, Member Board of Health, Upper Sandusky; J. W. Porch, Member Township Board of Health, Mansfield; N. Portz, Member Board of Health, Fostoria; James W. Price, President Township Board of Health, Plain City; H. S. Prophet, President Board of Health, Lima; C. H. Quayle, Madison; Dr. A. T. Quinn, Health Officer, Wilmington; W. Ramsey, Delta; John F. Rayner, President Township Board of Health, Piqua; F. S. Reefy, President Board of Health, Elyria; Henry Reiners, Member Board of Health, Cheviot; Wilson Rice, Member Township Board of Health, Germantown; J. W. Robinson, Sanitary Policeman, Ashtabula; Dr. L. L. Roebuck, Township Health Officer, Richwood; Dr. D. S. Sampsel, Health Officer, Ashland; A. H. Sargent, Akron; William Schaefer, Health Officer, Germantown; Dr. C. Edward Schenck, Health Officer, Thornville; Fred Schifer, Bucyrus; Henry Schmick, Defiance; B. Schlesinger, Xenia; Dr. A. C. Schwartz, Health Officer, Tiffin; James Sell, Sanitary Policeman, Canton; John C. Shaw, Member Township Board of Health, Wapakoneta; D. L. Sherwood,

Clerk Township Board of Health, Plain City; Sam Slade, Port Washington; A. J. Smith, Cairo; W. F. Sonnanstine, Clerk Township Board of Health, Shelby; Dr. Byron Stanton, Member State Board of Health, Cincinnati; W. T. Stevens, Health Officer, Thornville; L. A. Taylor, Clerk Township Board of Health, Tinney; W. S. Taylor, Member Board of Health, Bryan; Dr. H. L. Vannatta, Health Officer, Seal; Dr. W. A. R. Tenney, Health Officer, Cincinnati; John Y. Thompson, Health Officer, Kenton; John Tinkler, Health Officer, Bradford; Ed. Tittelbaugh, Adelaide; L. L. Toole, Chillicothe; William Treat, Health Officer, Brooklyn; Dr. H. L. True, Member Board of Health, McConnelsville; A. M. Turner, Health Officer, New London; Dr. Thomas H. Stewart, Member Township Board of Health, Churchill; C. F. Stolzenbach, Lima; Philip Strandler, Tiffin; Benjamin Swing, Tiffin; J. P. Taylor, Member Board of Health, Cheviot; Dr. N. B. Van Winkle, Health Officer, Blanchester; John H. Von Stein, Member Board of Health, Upper Sandusky; P. V. Wagner, Kenton; Dr. C. A. Walker, Health Officer, Louisville; Dr. Frank Warner, Member State Board of Health, Columbus; Douglas A. Weakley, Baltimore; J. M. Weaver, Clerk Township Board of Health, Thurston; N. Weingarth, Port Washington; P. Weisinger, Lima; Chas. Werthmiller, Tiffin; E. Wineland, Health Officer, Bloomdale; Paul Wisenmin, President Township Board of Health, Lima; J. H. Wolford, President Board of Health, Cedarville; Dr. J. A. Yoder, Lucas; H. D. Young, Pickerington.

FIRST SESSION.

THURSDAY MORNING, January 25, 1900.

The tenth annual meeting of the State and local Boards of Health of Ohio was called to order at the appointed time by the President, Josiah Hartzell, Ph. D., of Canton.

The President—Please come to order. It is by no means difficult for people animated by so sober and earnest a purpose as that which brings us together to come to order. I sometimes think we are almost too orderly; too sober and earnest. Convocations of this kind are apt to be commenced by invoking the Divine blessing, and sometimes by singing. No one could conceive of a purpose more deserving to have hymns of praise sung in its favor than that which animates the Ohio Boards of Health; and when it comes to invoking the Divine blessing, where in the world is there an object more deserving the favor of God than that advocated by our Boards of Health—the object of sanitation. Why, if you would cull the best texts in the entire Bible and interpret them in their best meaning, there is nothing in the world more in harmony with the teachings of Jesus Christ than the object of Sanitation.

Besides that, we all know exactly what we are doing: we do not have to appoint a committee to ascertain what our principles are, or what we

will believe in next year. We are all in favor of expansion; of the expansion of good health. We come together to review the burning topics of the day in our field, and to throw the same open to discussion, so that all may benefit from the observations and experience of all the others. We come from the north, the south, the east, the west, willing to learn; also to teach, if we have the gift of teaching; eager to give our experience, and to gain the experience of others.

One of the most interesting topics which engages the attention of sanitarians is consumption. We have all seen how that white plague settles down on individuals and families. It used to be thought hereditary, but modern research finds that it is not hereditary. Dr. Thorne-Thorne of England says that it is not hereditary in families, but that it is hereditary in houses. That gives us the cue to how it is spread, that is, by the careless distribution of the sputum of tuberculous patients. But there is still another method. Our modern investigators have shown that it is not only a disease of mankind, but also of certain food-producing animals, and that single phase of this great subject is now to be reviewed in our presence by Dr. A. W. Hopkins of Ashtabula.

Dr. Hopkins—Mr. President and Gentlemen: In speaking, as our President did, of the infection of houses, or the hereditary trouble with houses, he led me to think of what one of our physicians said to me the other day. He said he was attending the fifth person in a certain house in our city who died of consumption in the past five years. He considered it was just because the house was infected. The house had never been cleaned up—it does not speak well, maybe, for the Board of Health in Ashtabula, but one of our physicians should say that this house was not cleaned; but it is but recently that the Board of Health is waking up to the fact that consumption is one of the infectious diseases.

Thereupon Dr. Hopkins proceeded with the reading of the following paper:

THE PREVENTION OF TUBERCULOSIS IN FOOD PRODUCING ANIMALS.

By A. W. Hopkins, M. D., Health Officer, Ashtabula.

In this paper we do not pretend to bring forth any original facts or to present to you our own discoveries in regard to the cause and prevention of tuberculosis in animals or in man, but trust by bringing before you in as brief a manner as we can, with clearness, the investigations of men who have made it a study and have furnished us the facts, we may secure your hearty support of all reasonable regulations in dealing with this most dangerous and prevalent disease. From our study of the matter we are fully convinced that tuberculosis among domestic animals is a preventable disease and that its prevention is not only demanded in interest of the public health but would also be to the financial interest of cattle growers.

To impress upon our minds the gravity of the disease we will state this known fact. In the United States alone 336 persons die of tuberculosis every 24 hours or

14 every hour, a total of 122,640 in each year. Think of it. Ponder it well! What an army is yearly swept from the United States alone by this dread disease. Mortality statistics show that about one-seventh of all who die among civilized races die of tuberculosis in one form or another. For years it was supposed that tuberculosis was inherited therefore it was but natural that we should with almost fatalistic indifference watch the consumptive die thinking, it must be, there is no help for him. We now know that the disease is not transmitted by inheritance, that the child of tuberculous parents is not born with the germs of the disease in its system. The bacillus tuberculosis does not pass from parent to offspring. What a message of hope this must be to consumptives who have begotten children, but their responsibility has often been lessened for weak physical systems are no doubt inherited from such parents making the offspring more liable to contract the disease when exposed to the exciting cause, the bacillus tuberculosis. This bacillus or germ is communicated, by way of the mouth, or by inhalation, from man to man and from man to animals, from animals to man, and from animals to animals. Bacteriologists have proven the fact that tuberculosis in man and animals is identical, that the bacillus or germ is the same, that it acts the same in animals as regards inheritance or communication.

The investigations carried on during the past seven years in this and other countries prove that tubercular disease in food-producing animals is far more prevalent than has been supposed. The investigations in foreign countries have been more extensive than in our own. The British Royal Commission on tuberculosis in a report made in 1897 estimated that from 30 to 40 per cent. of the breeding cattle of Great Britain were affected with the disease. In 1894 Massachusetts enacted a law providing for a general inspection of the cattle of the state and during the four years 1894, '95, '96, and '97 21,390 head were tested, of this number 11,633 were condemned. In 1894 New York State Board of Health tested 27,000 cows that were supplying New York City with milk and caused the slaughter of 845 as tuberculous. In 1895 and '96 Vermont State Board of Agriculture acting as cattle commissioners under a special law tested 14,155 head of which 924 were killed as tuberculous. The New Jersey commission in 1897 tested 865 head of which 15 per cent. were condemned.

Connecticut in seven months of 1896 tested 2,032 and found 17 per cent. diseased. Pennsylvania Live Stock Board charged with the inspection of suspected herds had at the close of 1897 tested about 16,000 animals of which 15 per cent. were tuberculous. Out of a herd of 166 cattle belonging to the Pennsylvania State Hospital for the Insane 118 were found to be diseased or 70 per cent. But few of our states have provided for inspection of animals but enough has been done by State Veterinarians and Experiment Stations to demonstrate the wide prevalence of this disease. During the winter of 1893 and 4 the herd of 30 cows belonging to the Wisconsin Experiment Station was found to be diseased and the test condemned 28 of the 30 the test being confirmed by the autopsy. At the Ohio Experiment Station 132 cattle have been tested and 41 reacted to the test, but enough of this. In the year 1882 Dr. Robert Koch, of Berlin, demonstrated the true nature of tuberculosis by isolating the tubercle bacillus or germ. He also showed that the germ as found in the tuberculous human subject was identical in appearance with that found in tubercular animals and that the disease may be produced in animals by inoculation with human tuberculous material—on the other hand we have many instances reported by physicians where tubercular disease in children has followed in close sequence upon the use of the milk of tuberculous cows. Dr. James Law cites the case of a five-year-old boy from sound parents, whose ancestors on both sides were free from any taint, who succumbed to the disease after a few weeks illness, with acute tuberculosis of the lungs and enormously enlarged mesenteric glands. A short time before his death, the parents had

their family cow killed and found her the victim of advanced pulmonary tuberculosis. Dr. Demme records the cases of four infants in the Child's Hospital at Berne, the offspring of sound parents without any tubercular ancestry, that died of intestinal and mesenteric tuberculosis as the result of feeding on the unsterilized milk of tuberculous cows, these were the only cases in which he was able to exclude the possibility of other causes for the disease but in these he was satisfied that the milk was alone to blame. Dr. M. Stalker, Veterinarian of the Iowa Experiment Station, reports the death from consumption of five young people between the age of 20 and 30 from one family during a period of two years. Not a trace of the disease had ever been known in the family of either the father or mother of the children, but on the farm where the deaths occurred he found 17 cases of tuberculosis in the herd of cattle and others had died of the disease before the investigation was made. Many more cases could be cited but this is enough to show that the disease may be and often is communicated from animals to man through the medium of the milk. The cattle on our western plains that are never stabled and never confined in close quarters are found to be practically free from tuberculosis. The disease is extremely rare in cattle under 12 months of age wherever raised and when found in cattle under that age it may be almost invariably traced to the milk of tuberculous mothers or close confinement with older tuberculous cattle. From the investigations made at the Ohio Experiment Station they were satisfied that most if not all calves born of infected mothers were free from the disease at birth.

The eating of uncooked or *undercooked* meats is the cause of the disease being communicated to man—as an instance take our American Indians. The mortality reports show that about 50 per cent. of them die of tuberculosis. They eat raw, a great share of the beef furnished them. Even eating the tallow, liver and even the entrails while warm from the body. Taking into consideration the fact that the living germ or bacillus is the cause of the disease and is found in the flesh and fat of diseased animals is it any wonder that those who eat of it raw should be infected.

Our winters are so severe that our domestic cattle have to be housed much of the time and only turned out into close yards for a short time each day. Many of our stables are so small that there is not adequate breathing space for the number of cattle therein confined. Poorly ventilated, little light allowed to enter and often no direct sun's-rays, these conditions are the best possible for propagating the disease. The breathing of vitiated air produces a condition of lungs and system inviting the growth of the germs when they are in any way communicated to such animals. The action of light and sunshine being withheld, one of the surest aids in destroying the bacillus or germ is lacking and the danger of infection is increased.

The demand for protection against meat and dairy products from tuberculous animals is coming in from all sides. The lives of ourselves and little ones are placed in jeopardy daily. The financial interests of the state are also endangered—control by some means is demanded. Some legislative action regulating the sale of both meat and milk from diseased or suspected animals is imperative.

Since the time Koch demonstrated that tuberculosis was a germ disease, caused as surely by contagion or infection as is smallpox or measles—the fact has been confirmed by innumerable cases that tuberculosis has spread through a herd from a single infected animal. It has also been proven, that many herds are exempt from the disease. This demonstrated the possibility of eradicating the disease. It is preventable from the very fact that it is communicable. But how shall we come at it? It has often been shown that a cow that is far advanced with tuberculosis may take on flesh and look thrifty and to all appearance to the eye would be judged sound. Many animals suffering with the disease have no cough to lead you to suspect its presence. How then shall we know whether it is safe to feed the milk of any cow to our babe?

Dr. Koch after isolating the tubercle bacillus attempted to produce a substance which would render the system immune to the tubercle bacillus. He heated tubercular material until all the germs were killed and filtering the substance, he obtained a clear liquor, which he named Tuberculin. His hope was, that as Vaccine was a preventive of smallpox, Tuberculin would prove a cure or preventive of tuberculosis. In this he was disappointed, but it has proven the next best thing, namely, the most efficient diagnostic of the disease that has been discovered.

Its diagnostic value depends upon its property of causing an elevation of temperature in tuberculous cases, with doses, which produce *no* effect upon healthy subjects. Upon animals the test is made in this manner. The normal temperature of the animal is obtained by making several observations with a clinical thermometer, then a hypodermic injection of tuberculin of a given strength is made, the dose being graduated to the age and size of the animal, after a few hours the temperature is again taken and repeated at frequent intervals for the next ten or twelve hours. If a rise of temperature of two or more degrees occurs in from eight to sixteen hours after the injection, tuberculosis is to be suspected, and as thousands of such tests are on record in both Europe and America, where the tested animals were afterward slaughtered and post-mortem examinations made, the diagnosis whether positive or negative has been confirmed, so that this test is now considered diagnostic.

The dose is two cubic centimeters for a thousand pound animal or in that proportion for animals of heavier or lighter weight. To-day no buyer of thoroughbred stock who is well posted, purchases an animal from a breeder unless he will guarantee that it has been recently tested with tuberculin, and to have fully stood the test. No wide-awake breeder to-day will keep a suspected animal in his herd. He as thoroughly isolates such an animal as he would one known to be infected. He thoroughly believes in the contagiousness of the disease and knows his pocket-book will suffer unless he cleanses his herd of all diseased blood. We would not say to all cattle growers: Have each animal in your herd tested with tuberculin, but would say, if you have any cattle that are not thrifty, that you are in the least suspicious of, test them by all means. It may save you hundreds of dollars and more than all this may save the life of some member of your own family or that of your neighbor who buys milk and meat of you.

There is one thing, that can be more readily done to lessen the spread of tuberculosis among our domestic cattle than the one just mentioned. We have spoken of this briefly but wish to emphasize it, and to do so will quote Dr. Irving A. Watson, President State Board Cattle Commission of New Hampshire. "As the most efficient means of preventing the spread of tuberculosis in domestic animals sanitation must rank first, wherever we have found the disease to exist extensively in a herd, we have invariably found one of two conditions, namely that the animals were stabled in close quarters, with an entire absence of ventilation and cleanliness, thereby maintaining an atmosphere so warm that the temperature rarely reached the freezing point in midwinter; moist and charged with the effete stable products, thereby creating the very best possible conditions for the tubercle bacillus and its spread among the animals, or second, a degree of inbreeding among some of the thoroughbred herds that in all probability impaired the powers of resistance and rendered these animals particularly susceptible to infection."

Therefore particular attention should be given to the sanitary construction and care of stables and all places where domestic animals are confined. Be sure to provide sufficient cubic feet of air space for each creature therein confined, ample ventilation in all hours of the twenty-four, abundance of light (germs thrive best in the dark) keep the floors and walls dry—and with all these keep the entire stable clean. With such stables thus cared for, with the prompt removal of all animals

suspected of being diseased and at once thoroughly disinfecting their stalls, we believe that tuberculosis among our domestic animals would soon be among the rare or unheard of things.

Dr. E. K. Chapman, Defiance—The paper just read is an admirable paper on tuberculosis. I would like to ask the Doctor if they are using the tuberculin test in Ashtabula?

Dr. Hopkins—Not to my knowledge.

Dr. Chapman—It is highly important, as our country becomes thickly settled, to take this subject into consideration. Tuberculosis is being transmitted rapidly through the animal kingdom. I think statistics show that the animal does not transmit it to the human being as frequently as we used to suppose it did. The paper brings to us a great many suggestions, especially does it impress upon health officers of Ohio the fact that the constantly increasing population makes the danger arising from tuberculous cattle and tuberculous people greater every day. I, for one, am in favor of the tuberculin test, and I would like, along with the other health officers mingled here to-day, to see that test used in all the cities, villages and towns of Ohio. Give us a chance to stamp out this disease which is doing so much damage in our country.

I desire to commend the Doctor on his paper: I like it very much.

Dr. J. S. Howland, Plain City—I think the greatest danger we have to contend with is from man to man, in the spread of this disease, tuberculosis. Of course, there is a great deal of danger in the transmission of it from animals to children in the way of milk; but the most danger we have to contend with is from the tuberculous sputa which is being scattered broadcast along the streets and public highways, and upon the floors of the homes of many of our people, where it is left to dry, to be swept up with a broom, scattering the germs through the living room.

Ten or twelve years ago I was called into a house where there was a case of tuberculosis. They had bare floors and there were seven or eight individuals living in the house, which was a very small one of not over two rooms, and that sick patient was spitting upon the floor. I could see the stained places on the floor where it had been swept, but not scrubbed. I admonished the head of the family that the whole family might die of tuberculosis as the result of this; but inasmuch as they were ignorant people they paid no attention to me. I see in this room a gentleman who lives near the town where this family lived, and I think he will corroborate my statement that the entire family is dead to-day except the father and one girl. I think that this is where we have the greatest danger to contend with in consumption.

Dr. W. P. Clay, Mendon—I will say that I am in full accord with the last speaker and will give an experience of my own in that line. About seven or eight years ago, I examined the dust of 100 dressing rooms of ladies, in crowded cities, with the result of obtaining the bacillus tuberculosis in about 90 per cent. of all the cases. The explanation is that the

bacilli are spit upon the streets by afflicted persons and the long skirts of the ladies had gathered it up and carried it into these rooms. This points to the necessity of a reformation in two things,—the wearing of long skirts and legislation against the spitting nuisance.

I suppose that almost every one here has seen instances where two or three members of a healthy family have died in two or three years from tuberculosis. I recall a case where eight tombstones stand in a row, representing a family, all of whom had died of tuberculosis excepting one. The family lived in a log house and paid no attention to sanitation and they had the usual history of funerals. I think too little attention is paid by the medical profession to disseminating information of this character. It is the duty of a physician attending a tuberculous patient to inform the family of the danger and have every particle of sputum destroyed by disinfection or by fire. As to the danger of infection from animals, there are cases of tuberculosis of the intestinal tract which are no doubt traceable to milk or flesh of tuberculous animals.

Dr. W. C. Chapman, Toledo—I think this discussion is getting outside of the paper. To me the most important matter just now is the enlightenment of the farmer on the subject of the danger of tuberculosis from food-supplying animals, whether by milk produced from the cow, or flesh from beef or pork. This is the great question before the people now. The farmers are ready to take up the study in line with this question. There is not the least doubt now that tuberculosis has been carried to human beings by the animal, and no doubt many deaths occur in infants and children, from the milk taken unsterilized. We need to enlighten the farmers in regard to this question. The farmers in this country are advancing along every line, and are looking for knowledge just the same as other scientific people, and I hope, as we go to our homes, we will undertake to carry this news to them, and see to it that the farming population be informed as well as possible of the nature of this dread disease and what may be done to stamp it out by the use of tuberculin. I hope you will all hold up the hands of the farmers in the use of it.

Mr. E. G. Horton, Columbus—I wish to speak of one phase of this question, the transmission of tuberculosis from animal to animal. Until recently it was a mooted question as to whether bacillus tuberculosis was actually present in the sputum of cattle having pulmonary tuberculosis; but recently tests have been made which have shown the presence of the tubercle bacillus in the sputum. I saw an experiment made on a cow which was made to cough, a cloth being held in front of her mouth, and the sputum was examined and found to contain the bacillus tuberculosis. It is well known that cattle have a habit of licking one another: a third cow may come along and lick in the same place. There is thus an opportunity for the third cow to contract the disease. If a cow has tuberculosis it is a menace to the rest of the herd. The farmer may not think so, but if a cow has pulmonary tuberculosis, it may be transmitted as

suggested; or, if it has tuberculosis of the intestines, it may be scattered through the grass; or, if it has tuberculosis of the urinary canal, it can be scattered through the grass.

Dr. Probst—Dr. Hopkins has given us such an admirable review of the subject that one can do little more than attempt to emphasize the things he said. I shall call attention to the lack in Ohio of any law on this subject. We certainly ought to have a law on the subject, and that pretty soon. The State Board of Health is attempting an educational campaign among the farmers. That is, we have engaged speakers to present this subject of the prevention of tuberculosis in animals at the various farmers' institutes which have been held or are to be held; and it is the hope of the Board next year that this work will be carried out more extensively so as to spread this knowledge among the farming class quite generally.

I am not in favor of the plan adopted in some of the New England States of appointing a commission to examine the cattle and slaughter all found with the disease, but doing little to remove the causes which produce the disease. In Denmark it has been shown that it is unnecessary to kill tuberculous animals, or at least all of them. By using the tuberculin test for separating the well from the unwell cattle, it has been found that they can weed out in time the tuberculous animals, which may be used as breeding animals, because the calf is not born with tuberculosis, and if immediately taken from its tuberculous mother and put to suckle a healthy cow, it will remain healthy.

The paper has called attention to some needed reform in the construction of cow barns. Most cattle are kept in close, ill-ventilated stables during the winter. The Scottish farmers are giving attention, lately, to the necessity of heating cow stables. It is well known that when the temperature falls below 60 degrees, the yield of milk rapidly falls off. Without artificial heating, the only way of warming the stables is by the animal heat of the cows themselves; therefore, they are shut up tightly in dark stables and deprived of fresh air. I believe the farmer will find he would be benefited by building the stable so it may be ventilated and heated by artificial heat. At the last meeting of the State Medical Society this subject was discussed, and I think a committee was appointed to bring the matter before the state legislature. I think it was suggested that free tuberculin might be supplied to the health authorities, to be properly used under the supervision of a state veterinarian, or someone appointed for the purpose. There should be some means of examining herds supplying the milk to our cities and villages and testing them so as to prevent the sale of milk from tuberculous cattle.

Dr. W. A. Daugherty, Bucyrus—I will just mention the fact that I was one of the health officers instructed to present this matter before a farmers' institute. I said to them, "How do you know but you are scattering the germs of disease in the butter you sell?" And I said I would

rather risk the use of the imitation of butter, butterine, than to risk using butter from tuberculous cows; but I found that statement did not take well with the farmers. We now have no restrictions and allow those having this disease to run at large, while we are restricting diseases where the death rate is infinitely lower. I think we should take some steps along this line. Last year I recommended that the State Board of Health adopt a rule, requiring physicians to report families having tuberculosis so that literature bearing on the disease could be distributed. I am also in favor of a state hospital for tuberculous people, for if a member of a family has the disease and is taken to the state hospital, it removes the danger from that family. I think the State Board might recommend that all cows furnishing milk for the different cities and towns should pass a satisfactory test once a year. I believe that would be another step.

Dr. W. H. Leet, Conneaut—I would like to ask what would be the cost of testing a herd, say, of fifteen or twenty cows.

Dr. Probst—Outside of the cost of the tuberculin, there would be the veterinary surgeon. It is necessary, I believe, for him to be there 24 hours without rest, to take the temperature of the cow every hour, and thus the cost will depend upon the charges of the veterinarian; and like doctors, they do not all have the same price.

The President—The next topic on the program is "Disinfection of School Rooms and Public Conveyances after Exposure to Infectious Diseases," by Dr. Frank Warner, Member State Board of Health, Columbus.

Dr. Warner read the following paper:

THE DISINFECTION OF SCHOOL ROOMS AND PUBLIC CONVEYANCES AFTER EXPOSURE TO INFECTIOUS DISEASES.

By Frank Warner, M.D., Member of Ohio State Board of Health, Columbus.

It has seemed to me that the dissemination of infectious diseases through neglected school rooms and public conveyances after exposure to this class of cases is probably of sufficient frequency to claim, for a few minutes, our attention.

Often, as a physician, I learn of children leaving the school room sick of, what a few hours afterwards is pronounced by the physician who is called, diphtheria, scarlet fever, or whooping cough. And I regret to say that it has frequently occurred over our state of late that some cases of seeming chicken-pox, but in reality small-pox, have come away from the school with the disease unrecognized. This has not always been the fault of the physician by any means; for many parents are content to look after so simple a matter as chicken-pox themselves. No fault could be found with this if chicken-pox were always chicken-pox. But it is not, as has been proved time and again in different sections of the state.

In passing, it is evident there must be some real difficulties in the discrimination of these two diseases, especially in the peculiar form of the recent epidemic of small-pox. It has shown itself in an extremely mild form. Yet, not unlike that in at least one preceding epidemic. Of course, as you are well aware, some physi-

cians have unwillingly yielded to such a diagnosis, in some communities, holding for a time at least to the notion of chicken-pox.

This is not the time nor place, following the subject of my paper, to attempt to discuss points of differentiation in the diagnosis between these two diseases. But if there are some real difficulties presenting themselves in this discrimination, I then should wish to include chicken-pox in the class of infectious diseases which should call for the disinfection of the school which they had just left. Not during all seasons, but certainly when small-pox, of the grade which we have recently encountered, is in existence.

There is no question that in the present well understood matter of the prevention of the spread of small-pox, a school room would be disinfected if it were learned that an infected pupil had recently been present. But is it equally true of patients transported in public conveyances? Is there not a necessity of disinfecting public vehicles after carrying not only patients suffering from small-pox, but to a lesser degree those who are suffering from diphtheria, scarlet fever, or measles.

Then if there is a necessity of disinfecting vehicles after carrying patients suffering from contagious disease, it seems to me a considerable good could be done in their prevention by disinfection of vehicles used in the transportation of the dead who have died of contagious diseases. A hearse which has been used to transport a corpse which has died of any contagious disease, should be disinfected immediately after such transportation. Any express wagon used, as I understand they are occasionally used to transport especially those who have died of small-pox, should be treated in the same way. Such vehicles are a menace to those who come near them, for a greater or less length of time. Disinfection would immediately remove this danger, whether the danger be great or small. At least, it is only by attention to small details and the removal of small dangers that anything has been accomplished in the prevention of contagious diseases.

While disinfection has been undertaken in a few school rooms in the state, after the report of a contagious disease having been in that room, I believe it should become a general custom.

Right along this line, greater care should be given to the cleanliness of the school at all times. Whatever dirt chances to be present serves as a nidus to hold infectious germs and give them an opportunity to develop. Disinfection is accomplished with much less ease and still more uncertainty in the presence of dirt which may conceal the germs.

Then again, we should remember light, ample light at all times, is the eternal enemy of pathogenic germs. Just what prompts some janitors to draw the shades of the school room, placing it in absolute darkness, on every conceivable occasion, is more than I can understand. It is certainly a pernicious practice that should be abolished.

The dilution of the vitiated atmosphere of the room by ample fresh air is of great value at any time, but especially valuable at a time when contagious germs are present, brought in by some child whose clothing has become impregnated perhaps by an unknown exposure to a contagious disease. Dilution of the germs by fresh air has the same effect upon them that the liberal dilution by the fresh water of Lake Michigan will have upon the sewage of Chicago in their new drainage canal, where it will receive from three hundred thousand to six hundred thousand cubic feet of fresh water from the lake every minute.

The thorough airing out, or in other words the liberal dilution of an infected atmosphere in a confined space with fresh air serves as a strong aid to our disinfection. As the infectious air in the room is diluted with fresh air it not only allows a diminished number of contagious bacteria to bear upon the child but also resupplies something like a normal quantity of oxygen.

Scientists contend that with one per cent. of oxygen removed from a room, a burning candle loses five per cent. of its brilliancy. Is it unreasonable to suppose

that children breathing this air would suffer in their ability to resist the inroads of contagious germs?

What disinfectant should be used? Nothing, so far as we know, excels formaldehyd gas. It is reasonably certain in its action, and with slight expense.

It has now been demonstrated by a large number of observers that formaldehyd gas is perfectly harmless to the finest fabrics. Varnished articles do not suffer in the least: Neither do silver nor plated ware show any ill effects. The only line of fabrics that lost their color when subjected to this gas was that which very readily faded when exposed to the sun, so that practically this is no objection to its use.

To make the gas effective it must be generated quickly. Dr. Wyatt Johnston, Bacteriologist to the Provincial Board of Health, of Montreal, insisted on this point in his report on disinfectants, at a recent meeting of the American Public Health Association, in Minneapolis, to which I had the pleasure of listening. The more quickly you can fill the space which you wish to disinfect the greater number of germs you will have destroyed. If you require only one hour to generate the intended amount of formaldehyd gas to fill the space, it will be found far more effective than if you consume two hours in the generation of the same amount of gas. This is very easily understood if you come to reflect that some of the gas escapes from the crevices of the doors and windows, despite the fact that you may seal them by pasting paper around the crevices. It is important to bring the whole of the gas to bear upon the infected space as nearly as possible at one time, rather than to present the same amount in divided quantities. Any apparatus that fails to meet this essential condition is one to be avoided.

It is not the best time to attempt a disinfection by this gas during a high wind. The escape of gas from the crevices of a room of course is greatly augmented at that time. Yet, by extra precaution to prevent as much escape as possible, and by generating a little larger quantity than you would otherwise, the results will be quite satisfactory.

The temperature of the room exercises an influence over the effectiveness of the disinfecting power of the gas. It does better work in a warm room than in a cold one.

The Chicago Board of Health has dispensed entirely with a generator. They simply spray formaldehyd onto a sheet suspended in the room. In talking with their bacteriologist, Dr. Adolph Gehrmann, recently, at Minneapolis, he informed me that what they insisted upon was to get the spray entirely distributed over the sheet and not allow drops of any size to form anywhere, as this destroyed completely the effectiveness of its work. This plan has not been generally adopted, and it does not seem that a sufficient number of observers have reported upon this method to yet accept it as equaling the disinfecting power of the gas generated in the usual way. However, when no generator is at hand, and the necessity of the disinfection has arisen, this method should be employed, and you will at least have the authority of the Chicago Board of Health for its effectiveness. But until more observers approve this plan, it seems to me we should hold to some well approved generator.

Dr. W. K. Jaques, of Chicago, presented to the Section on "State Medicine," at the meeting of the American Medical Association, held in this city in June, 1899, a method of impregnating a room with formaldehyd gas by pouring formalin in hot water. He suggested keeping the water just below the boiling point, for the reason he states, formaldehyd gas is given off in abundance at this point, but the innocuous paraform if the water is kept at the boiling point.

This is not a method that has received the sanction of observers, however. He even goes so far as to suggest this method in the sick room, in the presence of the patient, generating the gas slowly. But any quantity of gas that a patient could readily stand, I am sure would prove entirely ineffective. The slow production of the gas is the very thing the best observers, and those who had been appointed to

work these observations by the American Public Health Association, insisted gave the poorest results; that the rapid production was what should be attained. No objections were heard to this latter proposition at the recent Minneapolis meeting of the Association mentioned.

One objection always arises where there is only a small amount of disinfection needed—that is, the expense entailed in securing a suitable generator to do the work. To meet this very objection, Dr. Robinson, of Maine, reported to the recent meeting of the American Public Health Association at Minneapolis, a method for the production of formaldehyd gas, that he assured the Association met every requirement. He simply makes a small box of sheet iron, perforating the sides and top; rolls up some heavy asbestos paper that will just fill the box, and then solders on the top. When he wants to disinfect a room, he pours in a proper amount of formaldehyd, saturating the asbestos paper. He then places his box over some source of heat and generates the gas.

Not having experience with this method, I cannot vouch for it, but from the well known reputation of the gentleman who makes this suggestion, I feel it is worthy of a trial at least.

There is little doubt that a large proportion of the nocuous infectious germs settle down with the dust of the room onto the floor and window ledges. The washing of these with a two per cent. solution of formaldehyd will come next in importance to the more general disinfection with the gas. Indeed, where the infection of a room is decided and of prolonged duration, there is an immense advantage in washing the floors and window ledges with the formaldehyd solution of the strength mentioned, in addition to the fumigation: For the germs may have found lodgment in crevices and become protected with surrounding layers of dirt in a way that prevents the gas destroying them.

Finally, if one has not at hands the best means of making a disinfection, it is much better to make some reasonable attempt than to let it go by default. Then, as opportunity presents, secure a generator that will develop a large quantity of gas in a short space of time, that the whole of the gas may act at one time upon the bacteria of an infectious character.

Dr. J. M. Hanley, Chillicothe—I think Dr. Warner is to be congratulated on his paper. It is about the most important subject before the Board. We have a standing rule that all conveyances used in funerals must be disinfected with formaldehyd solution. I think all places should have that as a standing rule.

Dr. Howland—We have had quite an experience within the last forty days with disinfectants. I wrote to Dr. Probst making inquiry concerning the disinfection of a greenhouse which was undoubtedly infected. The great question for me to solve was as to how to thoroughly disinfect that greenhouse and yet preserve the lives of the flowers. I finally solved the problem, and if I have committed an error, I am willing to confess it before you. I got a fruit tree sprinkler of one of our neighbors and made a formaldehyd solution, made twenty gallons of the solution, one to eighty, and threw that overhead and on the flowers until the surface of the flowers and even the ground was wet. We used two of those spraying machines. Some of the plants show some ill effects, while others do not appear to be damaged. I do not say it did them any good or that it would do for house plants; but one reason why it did not hurt them is that being

exposed to the sunlight so much, greenhouse plants are tougher than house plants which are more shaded.

Dr. F. E. Kitzmiller, Piqua—I represent a small town of fourteen or fifteen thousand people. Piqua has for years been a hotbed of diphtheria. I remember meeting Dr. Probst at the depot, a year ago last fall, and I had at that moment fifteen houses carded for diphtheria. Every day there was a new case or so, and I told Dr. Probst that I felt discouraged, and hardly knew which way to turn. We talked it over and he patted me on the shoulder and said, "Go ahead," and I went ahead. The first thing I did after leaving Dr. Probst was to hire an extra sanitary policeman. I visited every school house and gathered all the school books and thoroughly disinfected them with formaldehyd gas, and did it all in one day. The result was astonishing. It just blotted diphtheria out of the town, you might say. During all that winter we only had a case now and then, and by taking precautions soon got rid of it. Last fall, after having no diphtheria all spring and summer, school began on the first day of September. The children gathered up their old books from the closets, and got out their school clothes and went to school. I made arrangements to fumigate on the first Friday, as that was as soon as I could get to it, and those first five days brought five cases of diphtheria in five different families. I cleaned it up and had no new cases.

In Piqua we used the machine which has been talked about, but it blew up; and the past year we have been using a 40 per cent. solution of formaldehyd, using it in a large atomizer. We hang up sheets and spread some on the floor and spray them thoroughly. In a room twelve feet square, about the size of an ordinary bedroom, we use about three ounces and a half. Spray carefully and shut the room up and I will guarantee you will have no more diphtheria. I have sprayed rooms without injury to plants. We use formaldehyd in all infectious diseases. We do not disinfect for measles or mumps, but in diphtheria or scarlet fever, we depend upon formaldehyd gas, 40 per cent. solution, and use plenty of it. I am in favor of it because it has given us value received, and is the cheapest and most thorough thing we have ever used.

Dr. Smith, Cincinnati—On this question of fumigating schools, I would like to say a few words as to the method of generating the gas. Cincinnati has been using generators in its home work. This we put outside the door and throw the gas into the room through the keyhole. A while ago we had quite an epidemic of diphtheria in the mild form, and scarlet fever, also mild. Quite a number of the schools seemed particularly afflicted, so the health officer decided to fumigate the school buildings. But as there are between six and seven hundred rooms, and as there was but one fumigator, we adopted the Chicago sheet method, excepting that we do not spray the sheet. We take a sheet three times the size of an ordinary sheet and hang it down the center of the room. We use five ounces to the thousand cubic feet in houses where we have fur-

nsilings, but in school rooms we have plain walls and no furnishings excepting plain desks so that we think less gas sufficient, and we use eighteen ounces to a room. I am not able to say which method I like best, because we have done no experimenting with this outside of the schools. The generator generates the gas quickly, but you must remember the generator is used at the keyhole; the gas is not thrown in with any force, but simply taken up by the air and thus carried to the different parts of the room. I made an experiment to find how quickly this gas diffused in the room. I put a damp cloth over my mouth and nose and stationed myself in a far corner of the room. In a half hour the gas had not reached the corner so as to drive me out. The sheet is generally hung lengthwise of the room and presents a large surface for evaporation, and the diffusion of the gas is more rapid, I think, than with the generator at the keyhole. Consequently, I am in favor of the use of the solution by means of the sheet method. We use a forty per cent. solution and saturate the sheets.

A Member—How do you use the five ounces?

Dr. Smith—That is when we use the generator. We use five ounces to a thousand feet of space in a room where it is a furnished room.

Dr. Warner—Did you try any cultures there to see whether the germs were destroyed?

Dr. Smith—I did not make any tests. I found the corners of the room were filled in a shorter time than by using the generator at the keyhole.

Dr. Warner—So you do not know, as a matter of fact, whether the germs were destroyed?

Dr. Smith—No; to my mind the quantity of gas generated in a given space of time and the rapidity with which the gas is diffused would indicate the best method.

Dr. J. D. Geyer, Sidney—This discussion is very interesting to me, but I see some points which have not been mentioned. One thing is the curative properties of formaldehyd gas. I have used it almost exclusively through an atomizer where I have a child with the whooping cough, even after vomiting has begun. It has certainly a remarkable, almost a magic way, of combating whooping cough. I get the ordinary forty per cent., and give it to the family with a spraying apparatus and recommend them to use it not less than ten minutes at a time several times a day, and blow it anywhere except in the child's face.

Dr. Probst—Dr. Hendley, who has introduced a bill in the House on this subject of school disinfection, is in the audience, and I would be glad to have him explain what it is.

Hon. Frank W. Hendley, Cincinnati—Mr. Chairman and Gentlemen: I did not come here this morning for the purpose of speaking, but more to get information. I did introduce a bill a few days ago providing for

the disinfection of school rooms, and I think possibly I had better read it. I would like very much to learn whether it meets the approval of the members of this association, whether it is sufficiently radical or not.

Of course, we know if we attempt to enforce disinfection, we run against several objections. The first is, the matter of expense, which while it is not large, has to be considered. Also, there is the question as to whether the school board should stand that expense. Then as to the point of limiting exactly the degree of the existence of contagious or infectious diseases which shall require disinfection.

My bill is one to amend Section 2135.

A BILL

To amend Section 2135 of the Revised Statutes of Ohio.

SECTION 1. Be it enacted by the General Assembly of the State of Ohio. That Section 2135 of the Revised Statutes of the State of Ohio be so amended as to read as follows:

Sec. 2135. The board of health may take measures and supply agents and afford inducements and facilities for gratuitous vaccination and may furnish disinfectants and enforce disinfection.

It may afford medical or other relief to and among the poor of the corporation as in its opinion the protection of the public health may require, and during the prevalence of any epidemic may provide temporary hospitals for such purposes; and the said board is hereby required to inspect semi-annually, and oftener if in the judgment of the board it shall be deemed necessary, the sanitary condition of all schools and school buildings within its jurisdiction and may during an epidemic or threatened epidemic close any school and prohibit public gatherings for such time as it may deem necessary.

Whenever five or more cases of any one infectious disease appears among the pupils of any school during any period of thirty days, the board of health shall, within ten days, cause the thorough disinfection of such room and all ante-rooms and closets connected therewith, by the use of formaldehyd gas or other equally efficacious agency, and all furniture, desks, shelving, projecting ledges, floors and walls to height of six feet from the floor, shall be scrubbed with soap and water containing carbolic acid to a strength of at least two (2) per cent. During such fumigation or disinfection all books and slates shall be placed standing upon their edges and the books shall be open so as to permit, as far as possible, free access of the gas or vapor to all their parts.

The said board may require weekly or monthly disinfection of the school rooms, as described above, if any infectious or contagious disease exists among the pupils of the school.

SECTION 2. This act shall take effect and be in force from and after its passage.

Now, you will notice that this gives a very wide margin—"providing there be five cases in thirty days"—and the board of health "may at any time require disinfection," etc.

I have been much gratified to receive, unsolicited, a number of letters from persons interested in school and health work approving this bill, with very little objection to it—not objection, but suggestion as to improvement. Some think this should be ordered when any one case of infectious disease occurs. I think that would jeopardize the passage of

the bill, because it might be claimed by boards of health and education that it would keep them disinfecting all the time. It might not be a bad thing, as the gentleman from Piqua has given very startling proof of what would be accomplished by this method.

I would like to hear more about tuberculosis, not only in the human, but in cattle. I have been trying to draw a bill on this subject which would be satisfactory in my own mind, for the establishment of a state tuberculosis hospital. It is an exceedingly hard bill to draw and it will be exceedingly hard to pass, because it involves the expenditure of about two hundred thousand dollars. The people have not yet learned that human life is not to be measured by dollars and cents. I think we can easier pass laws for the protection of animals than for the protection of human life; but I think the subject should be introduced into the legislature and the responsibility of non-passage of it placed there. I shall be pleased to receive any information upon this subject. I confess there are many details of which I am ignorant, especially as to the scientific investigation of the disease in cows, and I hardly know how to get at the remedy. I hope the gentlemen who are informed upon the subject will let me know what there is on the matter.

Dr. W. L. Buechner, Youngstown—I would be in favor of confining that to five cases in a school. We had a little experience in our city with an outbreak of diphtheria; there were quite a number of cases—the majority all in one school house, and the Board took the responsibility and closed the school. We disinfected the house thoroughly with formaldehyd and stopped it. We must have had eight or nine cases in one school house in one month. We had five cases in one room. I would say, five cases in a school house, I don't care how many rooms you have got.

Dr. Warner—I should like to occupy a moment's time while Dr. Smith is here, as he might not be here this afternoon. I want to take issue with him upon one question. I do not think we should allow the statement to go out from here that the sheet method is the only one to be used.

Dr. Smith—I did not say it was the only method, but that it stands equal in my favor with the generator.

Dr. Warner—I question whether that has been sufficiently proved by different observers to accept it is the equal of a good generator. In the course of my paper, I recommend the sheet sprayed with a formaldehyd solution as one method when there is no other well recognized method at hand—by that I mean any method used for disinfecting a room which has been proved as destroying germ cultures placed in there. To recognize any method not backed up very generally by laboratory observers as destroying germs, is an empiric method which we have been getting away from by having the laboratory men come to our aid. And while not disputing that this method may be as good as any other, until it has

been proved by numerous laboratory men that it will destroy germs placed in that room—I am not willing to accept any such method as being scientific.

Dr. Smith used a sheet sprayed with formaldehyd. He reported this as the successful Chicago method. Yet he does not claim to have used a single control culture to demonstrate its efficiency. This is what I claim he should have done, especially as he has a laboratory at his disposal, before reporting the method he speaks of as a successful one.

Dr. Brown of Niles—I agree with the Doctor who has just spoken. We have had some experience in our small city with smallpox. We have been using the generator in the room. We tried the keyhole, but thought that too small. We used the 40 per cent. solution. By leaving the generator in the room it takes only a short time, and I think the quicker the gas forms, the better, and more liable to destroy the germs. We have disinfected thirty-one cases of smallpox in our town, and when a case has been disinfected and quarantine removed never has anyone else got the disease.

Thereupon meeting adjourned until the afternoon of the same day.

SECOND SESSION.

THURSDAY AFTERNOON, January 25, 1900.

The President—The time has arrived for the opening of the second session. The first number on the program is entitled, "The Necessity for Purification of Public Water Supplies in Ohio of Surface Origin," by Mr. F. Herbert Snow, C. E., Boston, Mass.

Mr. Snow read the following paper:

THE NECESSITY IN OHIO OF PURIFICATION OF PUBLIC WATER SUPPLIES OF SURFACE ORIGIN.

By F. Herbert Snow, C. E., of Boston, Mass.

In no part of the world have greater changes taken place in the last century than in North America, and in no part of North America have the changes been more marvelous than in the region of the Great Lakes formerly known as the Northwest Territory.

It is its mighty strides in ways of thinking and doing, its enterprises and interventions that have set the pace for the rest of the world. Its achievements in engineering alone baffle description, and hold the world in wonderment. No problem has been too vast for human ingenuity to tackle if there were profit in it. No obstacle too great to be allowed to stand in the path of progress.

Ohio's contribution to this development has been truly grand. She stands to-day possessed of a century's history that any commonwealth might envy and all must admire. While she counts among her jewels a Grant, a Sheridan, a Sherman, a Stanton, a Chase, and others of international renown, yet be it said to her praise, she holds dear to her heart the humblest of her citizens, and has dignified labor and honored her sons of toil with the best gifts at her command.

Failure to speedily provide for every immediate want of her rapidly increasing population has been only when she was in the dark as to the right course to pursue.

In Ohio's humble beginning, first came the sturdy pioneer to brave the hardships of the wilderness, erect his hut in the forest, hew down timber and break ground for the tillage of the soil and pasturage of cattle, and to contend with savagery for the advancement of civilization. Next came the mills for the grinding of grain and the sawing of logs. Next the development of mineral resources, and the springing up of industries and manufactories to utilize the product of soil and mine. And finally, by industry, invention, skill and genius, the vast resources and possibilities of the region were developed.

During each successive step of this progress the rivers and streams of the state have played an important part. They directed and made history. Along their banks the chief events of the century have been enacted. They invited settlement, then furnished transportation and power, fed canals, and determined the location of cities and industries and railroads.

This intimate participation in the physical and industrial development of the country has effected a change in the character and condition of the rivers and streams themselves. Formerly their flow was more even, the snows and rain-falls were retained by the forests and springs, and yielded up gradually. Now, pastures and cultivated lands take the place of wooded tracts. The ground is less sheltered and evaporation is thereby increased. Tile drainage of farm lands hastens the run-off water, springs are less copious, wells have to be sunk deeper, droughts are more frequent, and last longer, and freshets occur more often and are increased in volume and intensity. Rivers that were once navigable the year round now afford scanty supplies, and the universal comment of riparian owners is, that more water flows in winter and less in summer than formerly.

These changes have had their effect on climatic conditions and on the healthfulness of the country, notably in connection with humidity. It is doubtful that precipitation over large areas has been materially affected. The cause of precipitation is the sudden cooling of the air below dew point. Air ascending expands and cools. This ascensional movement may be brought about in Ohio, principally by solar radiation, whereby the lower layers of atmosphere become unstable in equilibrium and ascensional currents result, or by radial inflow from all sides, and ascensional movement in centers. In either case temperature, one of the three variable conditions controlling or affecting rainfall, might, and it would seem, owing to vast areas of land now exposed to evaporation, but formerly sheltered by forestry growth, would be considerably different, and hence we can logically conclude that local precipitation and electric currents, and wind movements have been sensibly affected by changes in the character of the watersheds.

That this has been a contributing cause to dispel certain diseases is conjectural, but it is positively known that the drying of the soil has greatly reduced the frequency of fever, and ague, and malaria complaints.

The greatest change, however, wrought by the permanent gathering of human beings in large numbers upon the watersheds of Ohio, is in the quality of the waters. It is this change which menaces the health of the inhabitants and demands serious consideration.

In their natural and primitive condition the streams came from springs and were pure and wholesome and of great value for watering stock, and suitable for all purposes for which pure water is generally used. But now, numerous cities, towns, and villages, and various manufactories having sprung up on the banks of the streams and therein discharging liquid and solid waste matter, regardless of the uses to which the waters may be put below, their filth, excrement, waste, refuse and unwholesome matters, poison and pollute and render unwholesome all such streams so that they are now unfit for the uses and purposes heretofore employed.

For several months in summer noxious odors arise from polluted waters rendering in numerous cases the premises along the streams undesirable to purchase, unpleasant to occupy and deleterious to the enjoyment of man and beast. These changed conditions furnish widespread annoyance, disturb and injure the rights of thousands of property owners as numerous suits now pending fully attest.

As a principal of law, the natural right of one proprietor to have a stream descend to him in its pure state, must yield in a reasonable degree to the equal right of the upper proprietor whose use of the stream may tend to make the water more or less impure. This is especially true in the case of a city where the population is dense. So that it is a rule of law that any person or municipality can be held responsible only for a substantial and appreciable injury caused by some specific use, and the fact that considerable pollution would reasonably find its way into a stream on account of the territorial extent of the city and the number of its inhabitants, must be considered.

We see, therefore, that it is legally and practically impossible to restore the waters to their primitive purity. Hence arises the inquiry, how much pollution is legally permissible, and what measures are possible and necessary to protect public health? Lack of time admits only of a passing reference to the salient features of this many phased problem.

To be of value our thinking must be done along practical lines.

MANUFACTURAL DRAINAGE.

As a general rule, industries make a city; as a general rule they require large quantities of water; as a rule they freight this water with foreign matters. The disposal of manufactural waste has become an important factor in the pollution of inland waters. Individuals and communities have encouraged this custom. Mutual agreement, either expressed or implied by custom, has dedicated the rivers and streams as common carriers of waste matters, and this dedication partaking of the nature of prescription, justifies, so far as it can be justified, the utilizing of water-courses as common carriers of manufactural waste. The number of manufactories is rapidly increasing. The carrying capacity of the rivers is gradually diminishing. Many streams which are sufficiently large to dilute and remove refuse in wet months, diminishing in flow to such an extent as to become insufficient for these purposes in summer. What can be done about this matter?

As a general proposition of law, a factory, or mill, or industry, may temporarily monopolize the flow, but they do so under the implied agreement not to spoil the water for ordinary uses below, which doing, they violate their license and may be compelled to abate the nuisance. But to insist upon a rigid application of this rule of law would work great hardships to industries all over the state and cause some of them to close their doors. The policy of the commonwealth has been to encourage industry, and statutory sanction of drainage into streams is a fact.

There is a class of cases where it may be an open question whether it is not for the public interest to allow the pollution of industry so long as it does not imperil the public health. It may be better to abandon the stream to this use, if the water is not used for drinking purposes, even if the few proprietors below have to suffer considerable inconvenience, rather than to drive away the industries and destroy the work of capital invested under presumed security of tenure.

This dilemma is an actual one in more than one community.

Where public health is imperiled, there is but one course.

Trade wastes when taken out of streams, must be disposed of in some way, and it is reasonable that facilities should be given the manufacturing plant, within city districts, to drain its liquids into the public sewer, provided this does not affect prejudicially the treatment of the whole sewage of the city, since the city is in the same boat with the manufacturer, and sewers are simply avenues for the convey-

ance of all the liquid wastes of the community to a common place of disposal. On the other hand it is also reasonable that the manufacturer should use the best available means to remove from the trade wastes everything that would interfere with the efficient handling of the mixed sewage.

In some English acts, dealing with the river pollution problem, provision has been made enabling authorities to prevent the discharge in the public sewers of certain classes of trade liquors, and these acts all seem to give authorities the power, although it is not expressly stated in a general act, to insist that the manufacturer shall, before obtaining admission to the sewer, use some means of preliminary treatment in order to deprive the trade waste waters of any properties which may injuriously affect the treatment of the combined sewage.

The fact that there are certain trade wastes which, if admitted to the public sewers, and mixed with domestic sewage, renders the purification of the combined sewage extremely difficult, has not as yet impressed itself firmly on the mind of local authorities. Now that purification of sewage is beginning to receive attention in Ohio, a policy towards the manufacturer must be defined.

DOMESTIC DRAINAGE AND DISEASE.

Coming back to the question of permissible pollution again, there are two standards or basis upon which to erect standards. One is that of a nuisance, and the other that of danger from pathogenic organisms.

We know that the wastes from a single individual will diffuse themselves so thoroughly throughout a great body of water that even chemical or bacteriological examination may fail to reveal the hiding place. If the daily wastes from an individual be diluted in 300 gallons of water, a nuisance will result; if the quantity be increased to 1600 gallons per day the water is not necessarily offensive, but liable to be under favorable conditions; and if the quantity be increased to 4600 gallons, this dilution is sufficient to remove all reasonable doubt as to a nuisance being created by offensive odors. The question of nuisance is therefore a question of dilution.

The question of existence or danger from pathogenic organisms is a different one altogether. While the liability probably diminishes in the degree of the dilution or dispersion, yet not much is known about this subject. All authorities, however, agree that cholera, typhoid fever, diarrhoea and intestinal disorders, may be transmitted by water that appears to be pure and unsuspecting.

Domestic sewage contains millions of bacteria, the greater part of which are inimical to life; some are doubtful and still others are of the pathogenic species. What becomes of these disease germs is not wholly known. The disease most commonly attributed to contamination of a water supply is typhoid fever, yet it is almost impossible to find the typhoid bacillus in sewage. This fact affords no guaranty that it is not there. Professor Sedgwick recently said of the typhoid germ: "It bears to the ordinary harmless germ of sewage, some such relation as do murderers to ordinary citizens in the passing crowd upon a busy street. They are few in number and outwardly resemble closely the law-abiding. Even expert detectives on the watch may not be able to discover them. It is only afterwards that unseen and unsuspected, they do their deadly work. Even then they may escape detection in the crowd, and it is only when circumstantial evidence is overwhelming, or when they are taken in the very act, red-handed, that their true character becomes manifest."

That dilution does not always destroy the pathogenic germ is known. Nothing thrives outside of its natural environment, and conditions in water not being favorable for its propagation and growth, the typhoid bacillus gradually loses its virulence and finally succumbs altogether. This accounts for the fact that sewage polluted waters are sometimes habitually drunk without a corresponding increase

in death rates. The human system is often enabled to throw off weak infection and to subject itself to these influences with seeming impunity. But the risk is most hazardous.

The typhoid bacillus is supposed to retain life for at least three or four weeks. It has been known to cause death after several months. The Plymouth case is a good example. Eleven hundred cases of typhoid fever, out of a total population of 8000 only, arose from the contamination of the water supply by one person. Several epidemics have recently occurred which were believed to be due to dredging operations whereby the deposit of years was stirred up and specific germs liberated.

Physicians declare that while the habitual drinking of sewage polluted water may not result in decimating populations by typhoid, yet the inhabitants are much more susceptible to other infections, and that were cholera to become rampant, the victims first to succumb would likely be those of this class. Because the penalty of wrong-doing is not executed immediately people become careless and skeptical. The doctrine of sanitation never makes such strides as when through adversity the penitent populace hastens to obey the commands of nature.

Glancing over the statistics of the four great cities of Ohio for 1898 we find a surprisingly low typhoid rate, when it is considered that their water supplies are polluted by sewage. Cleveland's typhoid death rate was 33 per 100,000 inhabitants, Toledo's 26, Columbus' 24, and Cincinnati's 26. In each instance the dilution is large. In each instance the pollution is increasing. Cincinnati is soon to purify its water supply, Cleveland is spending millions to avoid this expedient, and Columbus and Toledo have money for public necessities but not one cent for water purification.

Out of the pockets of the individuals of Columbus, for convalescent cases alone, is annually taken for doctors' and nurses' bills, and for prescriptions and special nourishment, over \$100,000. And this does not represent the various losses, and incidental expenses, and handicaps in life's struggle. This sum would considerably more than pay the cost of purifying the entire supply of the city. The results would be diminution amounting almost to extermination of the disease among city water takers. The average case of typhoid costs from \$100 to \$400. The daily cost to the individual, assuming his consumption at 100 gallons, for filtering the water, would be less than one-tenth of a cent. What cheaper insurance can the householder reasonably ask. Filters for each residence are no safe-guard, they are a check only. Public filtration of a public supply is the only assurance. It is an insurance which is a public duty.

There is no doubt that the difficulties of the social problem culminates in the city. There is no doubt that selfishness is the rule of action. There is no doubt that altruistic principles will ultimately prevail in spite of the political corruption of the day. Civilization will advance and whoever is foolish enough to stand in the pathway of progress must sink into oblivion.

Personal responsibility for our brother's welfare is our inheritance. This spirit came to these shores when our forefathers landed. It gave rise to this republic. It founded our institutions. It spoke in no uncertain tones, from college chair, forum, pulpit and press, in times of slavery; and it is not by might, nor by power, but by this spirit that the reforms of the Twentieth Century shall be accomplished.

It is a fact that attention to sanitation has reduced London's death rate from 80 to 20 per 1,000 inhabitants. It is a fact that in Europe, and notably in England and Germany, the use of raw surface waters is not practiced; prohibitory regulations being enforced, and the sentiment going so far as to require the sources to be filtered even if unpolluted. Too many million lives have been sacrificed to dread pestilence to admit of a vacillating policy at this date. In England there are two noted exceptions, Glasgow and Manchester; but the supplies in each case are without

human contamination. And so all through the European countries surface supplies are almost invariably filtered.

Cases are too numerous to mention, but the universal observation, without a single exception, has been that cities which used raw water had high typhoid and cholera rates, and cities filtering the water had low rates.

American cities are still pursuing the old European custom. Even here it has been observed that cities using unpolluted supplies have lower rates than cities using polluted supplies. The Ohio River is polluted by sewage and the cities in its valley have a high normal typhoid rate ranging from 50 to 81 with frequent epidemics running as high as 345 per 100,000 population, for a year.

In contrast, some European cities using filtered polluted waters have as low as 2 and 5 and 9 and 11 deaths per 100,000 population. London has but 17 and Berlin but 9.

In Ohio, the typhoid rates were for 1898, for cities over 100,000 population, 30 per 100,000, for cities under it, 33, and for villages and townships it was 41. What a blessing to the people would be the reduction of the rate to 5 and 2 as realized in Rotterdam and Hague. It is not extravagant to hope that this reduction will be realized in America before another century is run.

Today in the light of these facts, cities which are turning their sewage into Ohio's streams out of which at points below, water in its crude state is being taken for drinking purposes, are committing an offense. Communities that are violating the laws of health and laying themselves open to the ravages of epidemic, by drinking this water, may yet be visited by cholera or some plague, before they will wake up to a realizing sense that the laws of nature are no respectors of persons, and that unsanitary conditions in America are just as punishable as elsewhere.

Now, as courts have intimated that the aggregating of human beings on a territory implies accompanying pollution of soil and water flowing from it, and that a community has therefore a reasonable right to pollute rivers and streams to this extent, and that the ability of the streams to dilute the pollution, must be considered in determining the question of legal liability, it is evident that upon the lower proprietor rests the responsibility of taking such steps as are necessary to render the water suitable for his purposes, so far as removal of natural pollution, and the expense must be his. This leads to the conclusion, that few or no streams in Ohio are safe supplies for drinking water unless purified.

The situation is more firmly grasped by remembering that the removal of natural or legal pollution is as important for the proprietor seeking a drinking water as is the prevention of the more specific pollution of communal waste, which latter expense must be borne by the upper proprietor.

FILTRATION.

In considering remedies for pollution, the surface waters may be said to contain three classes of foreign matter, which, according as they exist in greater or less degree, make purification necessary. The first two classes are called natural contaminations, and affect the appearance of the water. They are vegetable and coloring matter, and mud and silt in suspension. They are not known to produce disease.

The third class is animal and pathogenic contaminations, which is without question dangerous.

Partial removal of these foreign matters is effected by storage and sedimentation.

Filtration is the only process which does not have to be supplemented. This process is physical, biological, and chemical. Briefly, the physical action is a straining out of particles larger than the interstices of the sand, and also adhesive action by which smaller particles are retained to some extent in the filter.

The chemical and biological actions are closely related. They result in the removal of organic matter.

There are two well known methods of filtration. Slow sand and rapid sand filtration.

Slow sand filters operate at rates of about 2,500,000 gallons per acre daily. Oxidation and nitrification are potent factors in the purification. The suspended matters are accumulated on the surface of the filter and require removal at frequent intervals, an operation necessitating the drawing off of the water, the careful scraping of the sand by hand, and the removal of the dirty sand. This removal of the surface deposit is the chief item of expense of maintenance. When the water is heavily laden with mud and silt, this kind of a filter is not economical, as too little time elapses between scraping. And besides, the very fine particles of silt permeate the entire body of the filter and require its entire refurnishing in time. For such waters, rapid filtration is more economical and efficient.

Rapid filters are operated at rates of one hundred million gallons per acre daily, or more. A mechanical device is used in stirring the filter while the sand is being washed by reverse current of water, which gives the process the name of "mechanical filtration." A coagulant is used to draw together the fine suspended particles in the water into a gelatinous clot. This accumulates on the surface of the filter and makes frequent use of the mechanical device necessary. Besides this physical removal of suspended matters, a chemical action, which reduces the organic matters in solution, the color, and the taste, occurs. The purification depends principally upon the kind of water treated and the amount of chemicals used, which are the principal factors of cost of operation.

It is seen, therefore, that there is an intimate relation between the quality of the water to be purified and the cost of purifying it.

Mechanical filtration is particularly efficient in removing suspended matters in silt-bearing waters. Slow sand filtration is safer when waters contain large amounts of bacteria and pollution from human habitation. The choice of the method is often a question of economy in installation. Generally it is cheaper to build a mechanical filtering plant than to build a slow sand-filtering plant. Within the limits of its adaptability it is generally cheaper to operate a slow sand filtering plant. Mechanical filtration possesses great advantages in the lesser amount of land required and the facility with which additional units may be added as increased use of water makes necessary.

Mr. Fuller, at Louisville, recommended mechanical filtration, because of the large amount and nature of suspended matters in the water. The silt being so fine, a clarification of the water ensured its bacterial purification.

Mr. Hazen, at Pittsburg, concluded slow sand to be safer from a bacterial standpoint than mechanical filtration; because while the amounts of suspended matter would not increase, the growing population would inevitably increase the number of bacteria in the water; and further that the efficiency of rapid filtration was made more doubtful by the alkalinity of the waters, which, at certain times of the year was insufficient to decompose the amount of chemical required to accomplish a proper standard of purification.

The project of purifying Ohio River water at Cincinnati, by subsidence and slow sand filtration, was found by Mr. Fuller to be inexpedient. Experiments prove that plain subsidence did not remove enough of the fine silt and clay, and that these matters would work through the filter and appear in the effluent. He therefore recommended plain subsidence supplemented by use of coagulants and mechanical filtration.

At Youngstown, Ohio, after an extended investigation, the experts recently recommended mechanical filtration, on the score of economy. The cost for a

million gallons of filtered water, including interest, depreciation, maintenance, and coagulants, was estimated to be \$6.50 for slow sand and \$5.89 for mechanical filtration..

CONCLUSIONS.

Regarding practical results, it may be said either method is efficient in removing disease germs. Ninety-eight per cent. reduction in bacteria is not an uncommon guarantee.

The city of Lawrence, Mass., had a very high typhoid rate—121 per 100,000 population—which continued until a slow sand filter was put in operation. The disease then almost wholly disappeared in families using filtered water, affording a good example of the efficacy of filtration. Ninety-nine per cent. removal of bacteria was accomplished. Not all the people used filtered water, so that the reduction in deaths was correspondingly lessened. At it was, the mortality was reduced 60 per cent. and nearly one-half of the remaining cases were due to the use of unfiltered water. This is an ordinary case. We must look to Europe for examples, where they may be found in numbers.

One further illustration, in passing, must answer: that of the cholera epidemic in Hamburg. This community comprises three distinct municipalities, Hamburg, Altona, and Wandsbeck. Hamburg proper used unfiltered river water which was thought to be safe. Altona used the same water but filtered it. And Wandsbeck used lake water. About 17,000 cases of cholera occurred in three months in 1892, about 9,000 deaths resulting. The disease was not epidemic in Altona or Wandsbeck. The lines of demarkation were most startling and significant. In one street, on the Hamburg side of the street, cholera was rife, while on the other side, the Altona side of the same street, which had filtered water, the residents were free from the scourge.

We conclude from the foregoing discussion. 1st. That specific infection of water may be a dormant infection. 2nd. That failure to detect the specific germ is no assurance of its non-existence. 3rd. That any water subject to human contamination is dangerous to drink. 4th. That the normal pollution of the streams of Ohio will naturally and legally increase. 5th. That it is unsafe to use these surface waters for domestic purposes without purification. 6th. That filtration is an efficient method of purification.

These being the facts, what excuse can a municipality or any corporation have for furnishing impure water to its customers. Public sentiment is no excuse. Public stupidity is no excuse.

The writer knows of one municipality in the state that takes its supply crude from a river, into which, within fifteen miles above the pumping station, the sewers of three cities discharge, and in summer, when the stream is low, the water is so polluted as to be undesirable as a source even to filter. The consequences are that the typhoid death rate in that city exceeds the average of the state by 64 per cent., the average of cities of over 10,000 population by 86 per cent., and the average of cities of over 30,000 by 100 per cent. Still further a comparison based on the percentage which deaths from typhoid fever are of deaths from other causes, is even more indicative of the suicidal policy of that community. The percentage is 86 per cent. greater than the whole state, 116 per cent. greater than for cities over 10,000 population and 139 per cent. greater than for cities over 30,000. The percentage of deaths to the number of cases is rapidly increasing also. Three years ago it was 10.1 per cent. and now it is 19 per cent. For the first six months of the year last past 10 per cent. of all deaths in that city were from typhoid fever. The next largest city which furnished statistics was 4.1 per cent. or this self-afflicted municipality had a rate 240 per cent. greater.

In the face of these facts, is there not need for sanitary reform? He who boasts that stupidity and skepticism are not extant, is ignorant himself. He who says that the pollution of streams is not a most serious question demanding urgent consideration, is quite likely to be found guilty of this very offense.

All that is lacking is positive proof of the direct connection between some particular case of typhoid fever and impurities in the water to precipitate municipalities and water companies into litigation and bankruptcy. If a highway be faulty in construction, or negligently maintained, and an individual is injured thereby, he may recover damages; and if the negligence be palpable, and result in loss of life, those responsible for it may be punished by imprisonment.

Health matters are paramount to all others. A water taker has a right to expect and demand that he be supplied with wholesome water. And if the authorities are negligent, and thereby sickness and death result, wherein has not the party, supplying the impure water, committed a criminal offense.

Let us hope that the day will soon come when Ohio will realize the enormity of the crime now being perpetrated on thousands of innocent citizens, and perceiving that conditions in this state are approaching conditions similar to those in older countries when pestilence stalked abroad, will take speedy action to establish modern methods of prevention, thereby maintaining her prestige as a leading commonwealth among a union of brilliant states, and assuring to herself at the close of her second century's history, a page bright with sanitary achievement.

The President—Gentlemen, the discussion of this paper will not take place until the next paper has been read, for the reason that the next paper has relation to the same subject. Years ago there was almost continuously before the State Board of Health an invitation to visit Lorain for the purpose of advising the people what to do in case of an epidemic of typhoid fever. Two years ago they introduced there a mechanical filter process which was not regarded with much favor by the State Board of Health at that time, but which afterwards vindicated itself; and the effect which it has had on typhoid fever is not for me to say, but for Dr. S. S. Cox, Health Officer of Lorain, who has been there all this time.

The following paper was presented by Dr. Cox, together with charts and drawings explaining same.

THE EFFECT OF WATER FILTRATION IN LORAIN IN REDUCING TYPHOID FEVER.

By. Dr. S. S. Cox, Health Officer, Lorain.

GENTLEMEN OF THE CONVENTION: I come to you this afternoon to talk to you about typhoid fever and some of the ways we get it.

You are all familiar with the history of the bacillus typhi abdominalis of Eberth, discovered in 1880, and probably all of you agree as to the pathogenesis of said bacillus in typhoid fever. If there are a few unbelievers we will say to them that, in order to positively demonstrate the causal relation of a micro-organism to a given disease, it is necessary to meet the following requirements, known as the four rules of Koch:

1st. The organism must be present in all cases of that disease.

2d. The organism must be isolated and obtained as an absolutely pure culture.

3d. *The pure culture of the organism when introduced into susceptible animals must produce the disease.

4th. In the disease thus produced the organism must be found distributed the same as in the natural disease.

The Eberth bacillus has met these requirements, and after being known and identified for twenty years by bacteriologists as conforming to these rules, may make a valid claim to be the causal factor in typhoid fever.

The origin of the germ is typhoid fever cadavers and the dejections of typhoid patients. We have been told at these meetings year after year, that you must swallow the bacillus to get typhoid fever, and that sometimes you swallow the bacillus and don't get typhoid fever. Why? The dense epithelial layers of the surface offers more resistance to the entrance of the bacteria than the delicate layers of the mucosa of the alimentary tract.

There is a constant battle going on between the cells and bacteria and sometimes the numbers or virulence of the bacteria are a little greater, or the cells of the body are weak and cannot destroy the invaders with sufficient rapidity, and the bacteria wins the day and disease is established.

Sewers were constructed in Lorain in 1892, and the main outlet was at a point about 1,800 feet from the end of the piers at the mouth of the Black River. The intake of the water works is about 1,700 feet from shore. The use of the sewers for sanitary purposes began in November of 1892, and very soon after that we had evidences that our people were getting more Eberth bacilli in their alimentary canals than they could take care of, and we had a large number of cases of typhoid fever.

Previous to the inauguration of the sewer system the number of cases and deaths from typhoid fever was only about such a number as would be expected where there is no special contamination of the water, and these were in the autumn months—the time when decaying fruits and vegetables afford such an excellent media for the growth of the typhoid germ. (I will here show you three plates showing colonies of the Eberth bacillus started from the feet of a fly who had just walked across an Eberth culture, demonstrating that infection may be easily car-reid by flies or other insects stepping into typhoid feces and then walking over culture media.)

In 1893 we had a large number of cases from January to June—months when typhoid fever does not appear excepting where the water supply is contaminated.

In 1895 the population of our city was so rapidly increasing and the number of cases and deaths from typhoid fever were so many, that our water works board called Geo. W. Rafter, of Rochester, N. Y., to make a thorough investigation and report—as to the course to be taken to insure a pure water supply from Lake Erie for the city of Lorain for all time to come. Mr. Rafter made a very complete report on June 1, 1895, which is printed in full in the Tenth Annual Report of the Ohio State Board of Health. His report concluded with the following recommendations:

1st. To extend new mains to a distance of at least two miles into lake.

2d. To make such further study of the possibility of filtration as may be necessary to determine just what results can be obtained with Lake Erie sands, reference being had always to ultimately filtering your entire supply.

3d. Purify the sewage.

4th. Decrease waste of water by restrictive measures, thereby lessening first cost of works and annual cost of operating.

On May 6, 1896, after going through the common course of changing any matter to a new system, a contract was made with the O. H. Jewell Filter Company for putting in six tanks with a daily filtering capacity of 3,000,000 gallons. These tanks were to be 17 feet in diameter, and contain four feet of silica sand, and were to be built of clear seasoned cypress, three inches thick, and having within themselves settling chambers of 80,000 gallons total capacity. They further agreed to have a bacteriological test to be run for six months, and expressly guaranteed to make an average reduction of not less than 97 per cent. of the bacteria in unfiltered water, with the understanding that this guarantee should be considered fulfilled whenever the number of bacteria in one cubic centimeter of the filtered water does not exceed two hundred.

These filters were put in use on February 7, 1897, and I now call your attention to the table showing the death rate from typhoid fever in Lorain for the past eleven years:

Population ...	4,500	4,860	5,200	5,600	6,000	8,200	11,400	12,000	12,300	14,100	16,600
Years	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
January					1				1		
February							3	3			
March					2	1			1		
April					6		4	1	1	1	
May					1		2	2			
June								1			1
July								1			1
August		1				2	1			1	
September ...	1		1	1	1		3				1
October			2			1		2		1	
November				2			1				
December	1										1
Total	2	1	3	3	11	4	15	10	3	3	4
Deaths per 100,000	44	20	57	53	183	48	131	83	24	21	24

Filters were put in use February 7, 1897.

Sewers constructed in 1892, and began using in October, 1892.

You will find this a very interesting table. You can readily see by this table without reading the note on the margin, that we commenced to drink sewage very soon after November, 1892; and a very remarkable fact is that the first death from typhoid fever contracted in Lorain after the filters were put in use on February 7, 1897, was in August, 1898. The death in April, 1898, being one that was brought in from some other city, while the ones in March and April, 1897, were ill at the time use of filtered water was commenced.

You may ask why we had more cases from January to July, between time sewers were first used and the time filters were started, excepting 1894. My theory is this: Lake Erie was not closed by ice during the winter of 1894, while during winters of other years it was closed for a long distance out. When the lake was not closed by ice the natural current is down, and when it is thus closed the ice interferes with this current, and the discharge from the river, instead of being carried down with the current, spreads out more easily and reaches the intake. Further, you do not get the same action of aeration and oxidation under the ice that you would if it were not present.

The bacteriological test commenced on February 24, 1897, and ended August 24, 1897. Four samples of lake water and four of filtered water were supposed to be taken each day for enumeration of bacteria and for estimation of amount of alum contained in water. Animal tests were to be made tri-weekly of both filtered and unfiltered water, according to Michigan method of determining presence of pathogenic bacteria. The report summarized is as follows:

Number of samples of raw water examined.....	364
Number of samples of filtered water examined....	364
Average number of bacteria in raw water per c. c..	2,122.37
Average number of bacteria in filtered water per c. c.	43.93
Average per cent. of bacteria removed.....	98

In no case was alum found in filtered water. Animal experiments showed that toxicogenic germs were almost constantly present in lake water before filtration, and at no time have they been found in filtered water excepting during a short period when a book was dropped into tank No. 3.

On July thirteenth, a party of about 300 inspected the filters. Tank No. 3 was washed for their instruction. Several catalogues of the filter company were given them. On July seventeenth the filtered water showed contamination of the filters. This continued until investigation by taking samples from each tank separately showed a bacterial count from tank No. 3 to contain 2,690 germs per c. c. when the lake contained but 565 germs per cubic centimeter. On digging up filter bed of tank No. 3, one of the catalogues was found in the sand—probably dropped in during the inspection of July thirteenth.

The number of bacteria in the lake water varies in an exceedingly short time.

May 22 —	Lake.	Filtered.
First sample	4,134	164
Second sample	11,448	84
Third sample	19,080	100
Fourth sample	19,716	174
May 24 —		
First sample	770	8
Second sample	270	10
Third sample	380	10
Fourth sample	460	18
June 16 —		
First sample	9,440	0
Second sample	5,634	4
Third sample	3,604	0
Fourth sample	150	16
June 27 —		
First sample	40	0
Second sample	80	2

And I believe bacteriological examinations should be made often enough to get a good idea of the effectiveness of the filtration. I made bacteriological examination of water from October 18, 1898, to December 18, 1898, one and one-half years after installation of filters with the following results:

Average grains of alum per gallon.....	1.2
Average per cent. bacteria removed.....	95.51

Thus, after running eighteen months and reducing the amount of alum one grain to one gallon, we still get good results; and, gentlemen of the convention, from any hydrant in Lorain you can draw Lake Erie water clear as crystal, and from 95 to 99 per cent. of the bacteria removed.

I will now give you a description of the filters and the manner in which they are operated:

As before stated, the filter plant consists of six tanks, 14 feet in height and 18 feet six inches outside diameter, with an inside tank 17 feet in diameter, containing a filter bed of fine silica sand 4 feet deep.

As seen by the illustration, there is a large space below the filter-bed-holding tanks called settling chambers, the capacity of which, in the six tanks, is about 80,000 gallons. The unfiltered or raw water into which coagulant has been introduced, is admitted into the settling basin through nozzle (N) which, instead of being directed towards stand pipe in center, is directed towards outside of tank producing a current around outside. This whirling motion promotes coagulation and sedimentation. The water rises through stand pipe (B) to the upper portion of filter tank where it is discharged upon the filter bed. The water then passes down through the filter bed (S) and through the strainers into pipes which are connected with the cast iron manifolds (F), which discharge through piping (G) and valve 5 into the clear water basin situated below the filters. This basin holds 225,000 gallons.

A float (D) is provided which connects directly with a butterfly valve which controls the raw water inlet and prevents the water from overflowing. We wash each tank every 12 hours. In washing filter bed valve 1 is closed and valve 4, which connects with the filtered water pumps, is opened permitting filtered water to enter piping (G) and pass through the strainers and sand bed into the annular chamber (A) through valve 6 into sewer.

The combined area of the collecting pipes in their cross section is about the same as pure water pipe, so that you can get about the same pressure through each strainer. While this is being done, the stirring apparatus or agitator is set in motion to assist in separating the sediment from the sand so that it may be carried off by the current.

After washing is completed, valves 4 and 6 are closed and valves 1 and 5 opened. The settling basins are washed once in four weeks, as follows: At the same time you are washing filter bed, you can use same water by closing valve 6 and opening valve 2, thus emptying basin and causing the wash water to rise high enough in filter tank to flow into pipe (B) and through elbow (E) into settling chamber with great force. The elbow (E) is connected to agitator shaft that passes through (B), and the water is thus directed to all parts of the settling chamber, washing all sediment through valve 2 into sewer. About 18 per cent. of total sediment is deposited in settling basin. The total cost of filters and building was \$30,000. Cost of coagulant 1.3 cents per pound. Takes 10,000 gallons of water to wash sand bed.

Every year at these meetings someone is supposed to tell you all about typhoid fever. How it is carried in milk, and how water is contaminated by excreta, and cite you a few well known examples as the one at Plymouth, Pennsylvania, in 1885, quoted by Osler, where 1200 cases of typhoid fever were caused from one man; and he is supposed to tell you about the effect of filtering water as shown by the cholera at Hamburg and Altoua, and you are cited numerous cases which show that the drinking of sewage contaminated water causes disease; and now people are beginning to realize that if they dump sewage into their water supply, the water must be filtered to make it potable, and this is done at a very great expense.

Philadelphia has very recently voted to issue \$12,000,000 worth of bonds for mechanical filters. Other cities are doing the same thing. After the filters are put in there is the cost of operating them. How can this be avoided? On the northern boundary of this part of the United States is the greatest body of fresh water in the world—the Great Lakes.

Let us have a National Board of Health that will allow no unpurified sewage emptied into that supply, and our neighbors across the way, we know, will do then

part, and then we can say to Cincinnati, Columbus, Philadelphia and other cities, "Come, and drink!"

Nature has placed the water and man has polluted it. If you do not believe this plan is feasible, look into it. And I believe the more you look into it, the more practical it will seem. The reservoirs are built and the supply is abundant. Protect it from contamination and draw from it at will.

The President—You have heard these two papers and the question is now before you for discussion.

No one appearing to have anything to offer on the subject presented in the foregoing papers, the President called for the following number on the program, and a paper was read by Dr. L. C. Grosh, Health Officer of Toledo, on "The Prevention of Diphtheria."

THE PREVENTION OF DIPHTHERIA.

By Dr. L. C. Grosh, Health Officer, Toledo.

In considering before you the subject of prevention of diphtheria, I do not expect to bring out any new or original ideas, but simply to suggest some of the salient points for your discussion.

In considering the etiology of diphtheria one cannot but be impressed with the amount and thoroughness of the work done on it prior to and since the discovery of the Klebs-Loeffler bacillus. In no other disease has it been so thoroughly demonstrated that the bacteriological cause complies with the four rules of Koch as in diphtheria.

Given the cause of this disease, it would seem a simple matter to find the origin of the causative factor, but all agree that no exact origin is known. It is agreed that it is developed by unsanitary conditions in general and transmitted from one individual to another either directly or indirectly. It therefore follows that the first step to be taken to prevent the spread of the disease is to enforce strict sanitary regulation and correct these unhygienic conditions.

The next question which presents itself is this: With the disease already established how to prevent its transmission, directly or indirectly, from existing cases. The first important factor, not only in the treatment of the disease, but in preventing its spread, is an early and correct diagnosis. If such diagnosis is not forthcoming, not only will the immediate family and associates of the infected person be exposed, but isolation and quarantine (the importance of which you all appreciate) are necessarily delayed. If the diagnosis be correct, but a report of it is not promptly made, absolutely no steps can be taken by the department of health to prevent the transmission and spread of the disease. From a preventative standpoint, in no other disease is the diagnosis so important.

The introduction of serum therapy in diphtheria has increased the demand for more minute discrimination and conclusion in the diagnosis of this affection. We have in diphtheria antitoxin, an antidote and successful means of preventing the development of the specific bacillus in the throats of those affected.

It has been discovered that other germs than the Klebs-Loeffler bacillus capable of producing pseudo membranes in the throat, larynx and nares, possessing clinical features in many ways simulating true diphtheria. All this adds to the importance and difficulty of accurate diagnosis.

Again, there is a bacillus that in every way resembles the Klebs-Loeffler bacillus, but is absolutely incapable of producing the disease. So it is plain that the

clinician and bacteriologist are often in doubt, and you must all appreciate how often this doubt will prove disastrous, not only to a community, but also to the records of its board of health.

Although the majority of the medical profession have not at their disposal properly equipped bacteriological laboratories, and must, of necessity, depend largely on bedside diagnosis, the procuring of such laboratories should be encouraged and certainly no health department should be considered complete without one. And although the fact remains that these pseudo diphtheria bacilli do exist, and such cases may possibly be reported as true diphtheria and quarantined, still this would prove true in such a small number of cases, proportionately, that they may be counted as naught.

It is erring on the safe side and the public should always be given the benefit of the doubt.

Everyone will agree that a case once diagnosed as diphtheria should be reported immediately to the department of health. This statement may appear unnecessary, but strange as it may seem, there are many of the profession who even today do not deem this necessary and wilfully neglect this duty, hoping to save their people from quarantine.

Now, although the success of every health department depends, in a great measure, upon the co-operation of the profession and their influence upon the people, at the same time it remains the duty of the department to enforce compliance with this measure. Such a measure may seem calculated to arouse the direct opposition of some of the members of the profession, but if all, without exception, are treated alike, the department is bound to receive the enthusiastic support of the better and more conscientious members. Reporting cases promptly themselves, they have the right to demand that others do the same.

The diagnosis established, the next step is absolute isolation and quarantine of the case and immunizing exposed cases with proper doses of antitoxin.

The question of quarantine is always a serious one among the classes of people in which diphtheria generally makes its first appearance—the laboring classes. It is serious not only because it is a great inconvenience, but by keeping the wage earners from their work or forcing them to remain away from the home during the quarantine, incurs an expense which is apt to prove a serious burden to them. Ordinarily this class of people will resist such measures, their mental capacity being such that they cannot understand and appreciate the importance of them.

Unless a quarantine is efficient in every detail the attempt to prevent the transmission of the disease will prove useless.

It has been claimed that absolute isolation and quarantine is impossible in the larger cities, but this, I maintain, is possible. It all depends upon the rules formulated and the efficiency with which they are enforced. That such rules can be enforced I am positive, provided that all classes of society, without exception, are held responsible and provided, too, that all offenders, rich and poor, are promptly and properly prosecuted by law.

The members of a community in which such offense is properly prosecuted will themselves act as guards and informers for a department which they know will enforce these regulations. To secure such co-operation it is imperative that printed explanations of the reasons and rules of quarantine be left at each quarantined house, and that they be printed in a language that the inmates may read and understand.

How long shall a case of diphtheria be quarantined, and during how many days is the disease capable of being transmitted? These are questions difficult to answer, even in the community where bacteriological examination is possible, as the number of days after the onset of the disease during which virulent bacilli may be found varies from ten to over seventy-two days. In cases where bacteriological examinations can be made, no quarantine should be raised until two nega-

tive attempts have been made to develop the Klebs-Löffler bacillus in the case. Where boards of health cannot have such examinations made, the state should fix a stipulated number of days for quarantine, and a set number of days before the recovered case is allowed at large, for, as soon as diphtheria becomes epidemic, and bacteriological examinations are not possible, nearly all cases that develop false membrane will be reported as diphtheria, and the department of health, without proper facilities for discriminating between them, is obliged to accept such reports. For example: A case of diphtheria is reported to the department. In two, three or four days this same case is reported recovered, free from contagion and ready for fumigation.

Now, this may or may not have been a case of true diphtheria. According to our present state regulations a patient is allowed to return to school seven days after fumigation.

In every diphtheria epidemic a large number of non-diphtheritic cases will be reported, and the reports must be accepted. Now, these cases reported as true diphtheria must, of course, be treated as such, and the department to protect itself and the public must treat them all alike. If some stipulated number of days is set for all cases the profession will be more careful in its diagnosis. They will consider the time the people are to be quarantined and there will not be so many men making records for curing cases and opening quarantines in from two to four days. I feel that as a rule cases are reported free from contagion too early, and it has been my experience that, as soon as a house is fumigated and the card removed, isolation is nil.

When we consider that over ninety per cent of all cases of diphtheria occur between the ages of two and nine years, the importance of the public school as a place where transmission is most likely to occur is manifest. The children exposed to contagion should be excluded from the school and separated from the case itself it is needless to mention: that the fall term of school marks the beginning of most epidemics and that such epidemics decrease markedly during vacations seem to prove the truth of these statements. Although the climatic changes of this time of the year (the fall) influences the development of all kinds of catarrhal conditions and sore throat, thus predisposing children to diphtheria. At the same time the bringing together of a large number of children aids in a great measure the transmission of the disease.

The subject of medical inspection of schools is now being universally discussed. In Boston, according to Dr. S. H. Drugin's report during the first four months of their medical inspection, 9,063 children were examined, of whom 5,828 were found to be sick, and 3,235 were not sick. The number sick enough to be sent home was 1,033. Of these 283 had contagious diseases, as follows:

Diphtheria, 58; scarlet fever, 19; measles, 42; whooping cough, 17; mumps, 35; pediculosis, 47; scabies, 33; congenital lues, 7; chicken pox, 22.

These children, supposed to be healthy, were in their seats, spreading contagious diseases among other children. The number of children saved from these diseases by this timely discovery and isolation of the sick children is, of course, beyond computation. Other diseases discovered necessitating treatment were: abscess, 22; adenoids, 59; catarrh, 244; cellulitis, 12; cholera, 8; colds, with more or less bronchitis, 224; debility, 63; diseases of the eye, 389; diseases of the ear, 35; skin and scalp, 186; throat and mouth, 3,489; epilepsy, 5; fracture of the collar bone, 1; headache, 171; indigestion, 42; malaria, 17; nausea, 50; Pott's disease, 3; swollen glands, 74; wounds, 21; miscellaneous, 411; examined for vaccination, 117.

This illustrates the importance of medical inspection of school children and schools for the prevention of contagious diseases in general, and of diphtheria in particular. For, when an epidemic occurs, a large number of mild cases of diphtheria exists for which the parents of the children see no necessity of calling a physician, at least until the disease has advanced far enough to become a source of

infection, and by this time an innumerable number of exposures may have occurred in the schools. In this manner the disease is rapidly spread, and our attempts at prevention are seriously delayed.

If the medical inspection of schools was at the present time the rule instead of the exception, health departments would be enabled to take prompt action in cases of this kind. The co-operation of the boards of education with the boards of health is an essential in the prevention of any contagious disease, and unless they act in harmony the efforts of the health boards to prevent the spread of contagion will again be crippled. When such medical inspection is not carried out the board of education should make it the duty of every teacher or person in charge of the pupils to ascertain the cause of every half day's absence. If such absence be caused by sickness, then the nature of the malady and the name of the attending physician, if any, should be reported to the health department. In case there is no physician, an investigation should be made by this department.

When diphtheria has become prevalent in a school room the room should be fumigated after the afternoon session, janitors should be instructed in the technique of disinfection and fumigation. Individual drinking cups and pencils should be furnished the pupils, and under no circumstances should an exchange of these articles be permitted.

That milk is a source and carrier of infection has been admirably pointed out by our Secretary, Dr. Probst. Milk itself is an excellent culture medium, and any water borne disease may be carried by milk, since water is the common diluent of milk. The milk may have been kept in a house where a person was ill and have become infected by the atmosphere. Milk tickets often convey disease, as they are almost always dirty. Milk bottles may be transferred from house to house and carry infection. The only way to control the conveying of disease in milk is by rigid enforcement of the permit system. The inspection of dairies, remodeling of cow stables, purifying water supplies and procuring the hearty co-operation of the dairy-men in his own interests. The registering of all milkmen, and persons dealing in milk, especially as most municipalities are furnished with milk from rural districts, is one of the greatest aids in investigating sources of contagion.

In causing contagious disease the water supply of a city is an important factor as is the milk supply. That impure water is a cause of the origin of diphtheria bacilli I am not prepared to say, but these bacilli have been found in water. An investigation of the water supply of those afflicted with diphtheria in Toledo I have found that over ninety per cent. of them procured their drinking water from bad surface wells, six per cent. from artesian wells, and only four per cent. of those afflicted were supplied with city water.

In Toledo diphtheria has been epidemic for years. During the past year, in the month of January 26 cases were reported; February, 39; March, 42; April, 26; May, 21; June, 18; July, 11; August, 53, and in September, at the opening of school, 147, which increased in October to 177. Then most strict quarantine regulations were enforced, and the department met the co-operation of the school board. November, 104 cases reported; December, 45 cases, and to January 20th, 19 cases were reported. Of these nineteen, fourteen have been fumigated, leaving but five active cases at the present time.

The greatest increase of cases, as you will observe, occurred during September at the beginning of school. The disease since that time has decreased, due to the rigid enforcement of quarantine rules, and by not allowing fumigation until at least ten days after the disappearance of the membranes from those afflicted.

And since January first of the present year, in compliance with the new state regulations, children have not been allowed to return to school until seven days after fumigation of the premises.

The board of education has required the teachers to inquire into cases of absence, and the health department has investigated where there was no medical

attendance. The department of health in Toledo is far from what it should be, not having at present the funds to procure necessary improvements. We have no bacteriological laboratory, no medical inspection of schools, no dispensary for antr-toxin to immunize exposed persons, but still we have been able in some measure to control the disease simply by strict quarantine enforcement.

The President—This subject is now open for discussion.

Dr. Smith, Cincinnati—I only have a few points which I wish to present in regard to this paper. As I mentioned this morning, we have just passed through a slight epidemic of diphtheria and scarlet fever. I believe that any precaution taken for diphtheria should be taken for scarlet fever. Diphtheria is a little more to be dreaded than scarlet fever—not much. In regard, then, to absolute quarantine: I say that it is impossible in several senses of the word, in a large city or in a small city. Absolute quarantine means guarding that house day and night; and if there are two entrances, it means there must be two men there in the daytime and two men at night. Taking Cincinnati, we have had as high as 15 cases of diphtheria and 18 cases of scarlet fever in one week. These cases do not get well in one or two days; they take a week or more. We have 64 sanitary officers for maintaining quarantine, and have to have men for other purposes—we have to have men to fumigate and have to have men to inspect premises, etc. A gentleman spoke here this morning—I do not know whether he said they had ten or sixteen thousand population, but they had two sanitary officers. Give them five or ten cases and where do they come in? You may placard the house from roof to cellar, but you can't keep the people in. Where is the use of maintaining quarantine unless it is absolute? You must not let a man or woman go to the grocery. Another thing: take a man earning nine dollars a week, and there are a great many earning that and less with families of children to support. Quarantine that man—you can't afford to lock him up and maintain the family. A great majority of cases the physicians report as recovering in five to seven days; a great many take three or four weeks. The man would lose his job and you would have to provide him with another. So I say that absolute quarantine is impossible.

There are other germs causing a membrane in the larynx or throat simulating diphtheria, and only a bacteriological examination can determine the difference. Although I am a bacteriologist and make examinations every day, and have all faith in such determinations, I say it is impossible in all cases of diphtheria to get such a determination. A great many physicians have graduated before the study of bacteriology, and we have to trust the physician, and he may not properly make a culture. He will send it to you and it is negative; you don't quarantine or placard, and yet it may be diphtheria.

Then the membrane does not always appear in the upper part of the throat and he may take a culture from the upper part of the throat which

will show negative. I had not long ago a culture which was negative. The Doctor said, "I cannot understand it, the case is serious." We quarantined it anyway. The disease progressed and it was necessary to use a tube. Afterwards the tube was removed and it was "alive" with diphtheria bacilli. So we must not rely entirely on bacteriological examinations. If there is the least suspicion, quarantine. If you find you are mistaken, you do not need to quarantine so long. I say, quarantine every suspicious case, even if there is no membrane; but absolute quarantine is absolutely impossible.

The Doctor said not to dismiss the case, not to raise the quarantine, until two attempts of examining the culture have proved negative. We require that when the patient is considered well by the physician, he shall make a discharge culture, and if it proves negative in a few days longer the child is allowed to go to school. We have every trouble with physicians: good physicians, in getting them to make this discharge culture, they say we are encroaching upon their rights, that they are capable of deciding whether there is any further danger from infection and refuse to send the culture. The family complain and want the card down, and the physician refuses to take the culture; so we feel that we are doing well when we get one discharge culture. I do not know of but one or two cases where we failed altogether to get a culture, by means fair or foul.

Dr. W. C. Chapman, Toledo—You say this is a matter of education of the people. It is also a matter of education with physicians. It is the duty of the physician to educate the people, to educate the family of the case he is attending. Every physician who is prompt and energetic and knows what he is doing has it in his hands to quarantine. I do not want any idea to be carried away from this meeting that quarantine cannot be established. Take an intelligent family with two or three children and put it to them in this way: "Do you want to put these other children in position to have a disease from which they may die?"—and not one in a hundred will not say, no. Then the physician will say, "What you should do is to send these children away," and they can and will do it. I now have three cases of scarlet fever and two of diphtheria under my observation. One family is not well educated. I have had no trouble in quarantining these families thoroughly. The father of one family has not been in the house for three weeks. One child was sent to an aunt, another to a friend, and they are both going to school. The mother in taking care of the child stayed in one room three weeks. I had another case of diphtheria. The man was a member of the Board of Trade and a busy man, and he did his business for three or four weeks over the telephone, and he had a large business. I have no patience with people who say you cannot quarantine. We can. You, as health officer, can cause it to be done, can do it with your people. Watch your families, lecture your families, and bring them to know that quarantine is the only way to avoid danger.

Dr. J. F. Marchand, of Canton—I simply want to say this, that I think in these days of investigation and scientific demonstration, the question may reasonably be asked, “What shall we eat, what shall we drink, and wherewithal shall we be clothed?” Now, the question of quarantine is a question, I think, which has always disturbed the boards of health of this State, and it is likely to continue to do so as long as state and local boards continue to exist. The Doctor’s paper I want to endorse. He read a thoughtful paper and raised some questions we will do well to consider. We cannot quarantine absolutely, but the gentleman who has just taken his seat has voiced my sentiments. I think each of us will realize the truthfulness of what he has said, viz., that each one of us has a duty to perform in teaching, educating the people into the sanctity of whose homes we are called as physicians, telling them what is to be done to prevent disease. It seems to me, in my official capacity, that the great spread of diphtheria is in families who are ignorant, or where the physician has failed to tell them the true nature of the disease. How many physicians tell their families of the nature of diphtheria? He should tell them that every spoon, fork or dish taken into that room for the administration of food or medicine for the patient should be washed in antiseptic solution and not taken to any other place, but kept separate and apart. How many tell their patients that all refuse, all cloths, should be burned.

I want to say for the medical profession, that the doctor who diagnoses his case at the bedside clinically, ought to be able in the large majority of cases, to tell whether it is diphtheria. I want to endorse all that has been said for bacteriology. It has been rightly said that the bacteriological and clinical symptoms are not independent of each other, but complementary. We cannot let the patient wait until we get a report that the bacillus is there. If we do, we will have funerals; there will be new graves dug and there will be new funeral processions.

I want to say further that things must be called by their right names.

If a man has anything in his practice that looks like diphtheria, he ought to be honest enough with his people to tell them that there is a suspicion in the case and it must be watched carefully until a positive diagnosis is made. We can’t tell everything yet. The time will come, I believe, when the increasing use of the microscope and the bacteriological laboratory will enable every physician to tell more definitely the nature of the disease he is called upon to treat. Every physician should be watched in the community by the board of health, and see if he has two or three or more cases of the same nature and no case reported as diphtheria. Then go to him and ask what the disease is. You are not trespassing upon his rights, whether the disease is diphtheria, scarlet fever, or small-pox. Not long ago I was called into counsel, and found seven cases in one house—but no diphtheria. Four cases died of diphtheria and one almost died of membranous croup—and no diphtheria! Since then the

alarm has been raised and the schools cleaned, and I hope, through the mercy of God, the plague of disease has been stayed.

I want to give all glory to the old doctors of the profession who sit at the bedside and study their cases clinically; all glory also to those who examine their cases with the microscope,—but we cannot wait for the microscope. We must learn from our alma maters to judge from the clinical symptoms. We can't run off to the laboratory, or send to the cities to have tests made in order to determine the nature of the disease,—tho' I believe that the time will come when all cities of a certain size will have bacteriological laboratories well equipped to settle all questions referred to the microscope.

Dr. Smith, Cincinnati—I have evidently been misunderstood. The question has been argued here as it is, and not what it ought to be. The gentleman who has just been talking stated that with his whole soul he advocated quarantine, and in the same breath he says he does not believe absolute quarantine possible. With all my soul and body I wish we could have absolute quarantine, and I will say that the Board of Health of Cincinnati has gone farther even than they are allowed by law, and where we cannot reason with the people we go farther and bluff them into believing we have powers which we do not exactly have. But there are cases we cannot learn of. The greatest drawback to our maintaining quarantine is the physicians themselves. They will go to a family, and say, "They (the board of health) have got no right to do that,"—"They have got no right to fumigate." The man who does that is an intelligent physician. It is easier to educate the people than it is to educate the physicians. I am so far in favor of quarantine that I advocate the establishment of hospitals for infectious diseases where children can be taken and absolute quarantine maintained.

A Member—Why not quarantine by consent of the people?

Dr. Smith—We can't get the consent of the people where the physicians back them up. Some of the best physicians of Cincinnati fight us tooth and nail; they misdiagnose cases in order to keep them from us. We go so far now that in every case of membranous croup we put up a sign of diphtheria.

A Member—Did you ever send a committee of doctors to diagnose a case?

Dr. Smith—We have done that in several cases.

A Member—Did you ever prosecute the doctor?

Dr. Smith—The law provides for the case to be reported by the physician to the health department within 24 hours after diagnosis is made. If they have never made a diagnosis of a disease which comes within this provision, how can you prosecute them? I believe a child's life is worth more in dollars and cents than it costs to quarantine. We know what it costs to bury them and it would cost less to quarantine; but you can't get the money to quarantine the cases properly. So that I say under these

prevailing conditions, with such weak, inadequate laws as we have, and the courts all over the land deciding against us, what can we do?

On motion of delegate from Ashtabula, a rule was made that no speaker should speak longer than two minutes until everybody else had an opportunity to speak.

Dr. J. M. Hanley, Chillicothe—We have a population of about twelve thousand inhabitants, with absolute quarantine laws. Two years ago the quarantine laws were very lax, but during the last year quarantine has been carried out very thoroughly without a sanitary officer to watch over the people. It is all done by educating the people up to it. When a case of diphtheria is reported a sanitary officer placards the house, the head of the family is given the privilege of staying in or out, and we have never had an instance where the head of the family went back until authorized to do so. The neighbors in that locality are sanitary officers for us. I have been notified in five minutes when an attempt was made to disregard quarantine instructions.

A Member—Doctor, you live in a good community.

Dr. Hanley—The physicians all help me.

Dr. M. J. Jenkins, Plain City—I simply want to say a few words, and that is, this thing of saying that you can't enforce quarantine is all "tommy-rot," and I wish to endorse the sentiments expressed by Dr. Chapman, of Toledo, with one exception, regarding sending children away. That is all very well if you can get neighbors or friends to receive them, but if they will not receive them, we do the next best thing and isolate them in separate rooms. As soon as a patient shows evidence of a contagious disease we separate him from the rest of the family, allow no one in that room but the nurse, and as far as practicable quarantine. It is impossible to quarantine each house. The expense is so enormous that we cannot consider it for a moment. We find the neighbors the best sanitary officers. We have a report immediately if a member of the family steps out of doors. They are then warned, and if they persist in going out of doors without authority we have them arrested and promptly punished, and there is no trouble in our town in keeping the people in quarantine.

Dr. S. S. Cox, Lorain—I am sorry to hear the people of Cincinnati are so bad. In Lorain when we placard a house, if anyone is caught stepping out of the house except the doctor, he goes down to the police court and pays eight dollars and sixty cents, and we have there a kind neighborly feeling which brings us information as to whether any one steps out or not. People come around and ask to be quarantined.

Dr. W. P. Clay, Mendon—I am sorry to say that we have not as good doctors, or as well educated as other towns. It seems to me that as there was even a Judas among the disciples, we ought not to expect all physicians to be saints. I have had experience in quarantining in a small place and the difficulty seemed to be largely among the members of the

profession. (Dr. Clay details case where by advice of one physician a family was quarantined, another physician diagnosed the case differently, and the Board of Health was "roasted" in the town papers.) We have had it up and down hill, and are going to take somebody to the police court if there is any more trouble.

Dr. L. F. Laudick, Lima—We haven't the worst town in Ohio, I rather think it is not as bad as the one just heard from. But we do have fun in handling these cases. I have tried in the past four years every method of quarantine, nearly, which has been suggested at our different meetings. I believe that absolute quarantine is possible. Our records show that we have practically succeeded. We have been trying of late a method suggested here two years ago, that is to allow the man of the house to act as guard over his own flock. It has been found to work well, but in all cases I have known my man before I tried it. When you ask a man to quarantine his own family, if he is inclined to be mean, he will be all the meaner because you have trusted him. The neighbors are always good guards, but sometimes cause more trouble from the reports they bring than they do good. It would take a force of 25 sanitary policemen to look after each case. We cannot afford to keep that many police. But the expense is not the only thing to be considered, for if we stop the disease, if we save one life, it is something not to be counted in dollars and cents.

Dr. J. S. Howland, Plain City—We have had as much experience along this line in our town within the past forty days as any other town in the State of Ohio not having more inhabitants. The physicians of our town are all in harmony with us in regard to the enforcement of quarantine rules and we have enforced our quarantine rules pretty rigidly. The Board of Health has been providing for the wants of all indigent persons. We had a day sanitary police and a night sanitary police only. The day sanitary police has been looking especially after the wants of the families quarantined. I reported to Dr. Probst a few days ago that we had already had 68 cases of smallpox. The greatest trouble we have to contend with is due to the lightness of this form of smallpox, and some families have made an effort to hide away a mild case, so as to prevent being quarantined. There have been two such cases, and only after a new case would develop from the contagion of the hidden case were we able to run it down. We had 25 quarantined families in our town, and have been successful in blotting out the disease unless something further develops from those two hidden cases.

Dr. Brown, Niles—We have not had as many cases as the Doctor here reports, but we have had enough. We had 31 cases and have got one left ready to be discharged Friday or Monday. We quarantined each house and had a watch. The Doctor over there spoke about letting each man be his own watch. We tried that once, but it was not successful. I think there should be a pest house and in that way we could prevent a good

many cases. If one man is taken with the disease and there are seven or eight in the family, if he is taken away at once the chances are that no one else will have it; but if you leave him there, all may have it.

The Chair—We have wandered off from diphtheria to smallpox.

Dr. Smith, Cincinnati—Cincinnati is not a particularly bad city—it is not a Utopia, not a Zion—but the neighbors do not make good sanitary officers. They even tear down the placards in order to prevent the block from looking bad. We have physicians as good as can be found anywhere, but the 100th man can do more harm than all the rest of the 99 can do good, and there is where our trouble comes from.

Dr. Grosh—I have learned a good deal from this discussion, and it has paid me for writing the paper.

What I mean by absolute quarantine is following out the letter of the law furnished by the State Board of Health. In our place, without exception, the man who breaks a quarantine is prosecuted and fined. The diphtheria there started out in the Polish settlements and they were very hard people to manage. They were handled by a Polish doctor and spoke the language which the officer could not understand. The only way we managed them at all was by applying to their priest who explained to them that this was no persecution but was for their own good. This explanation was printed in their language, and in ten days the disease was fifty per cent. less. What I meant to bring out in this paper was that by quarantine, starting out only a few months ago, we have been able to not stop it entirely, but to diminish it.

The President—I believe that closes the discussion. The next paper is "An Explanation of Results Obtained in Bacteriological and Chemical Analyses," by Elmer G. Horton, B. S., Bacteriologist, State Board of Health.

AN EXPLANATION OF RESULTS OBTAINED IN CHEMICAL AND BACTERIOLOGICAL ANALYSES.

By E. G. Horton, B. S., Bacteriologist Ohio State Board of Health, Columbus.

"Never was there any public good,
But that was at first misunderstood."

He who spoke the above, spoke truly, and passing events have continued to bear witness to the truth of those few words. Following the progress of science, there have come to our people, many useful applications of the knowledge thus gained, and of one of these benefits to the public good we speak to-day, viz: The value of bacteriological and chemical examinations. We have no exception here to the above quotation, for there is much that has been misunderstood in relation to the scope, meaning and value of sanitary analyses, so this little paper is presented with the hope that it may be helpful in clearing away, in part, the mist and enabling us to behold more clearly our objective point.

Let us first consider the true value of the position which should be given these analytical processes in the subject of sanitation. It should be said at the outset that no chemical or bacteriological examination of any sanitary specimen

ever told everything about that specimen. There are things which analyses cannot tell, and, accordingly these processes furnish but part of the information necessary to determine the true status of affairs. The analysis of itself must not be considered as the one thing, the only and all sufficient thing needful, but must be taken as a *help* to be used in connection with other possible information concerning the case. On the other hand, one who rejects the analysis as worthless because it fails to do everything, is likely to find himself in much the same attitude as the man who put his eyes out one night because he could not see in the dark, and the next day found he was the loser. There have been cases of dangerous drinking waters in which the only notes of warning came from the analysis, and from the use of the water. The test of a water by drinking may be a telling one in some cases, but it may prove to be costly information.

With then the analysis properly placed, viz: only aids or helps toward an end, but, as such, valuable and often indispensable in putting one in the proper position to judge correctly in certain sanitary problems, let us consider the meaning or interpretation of some of the analyses frequently brought before us.

First, last and all the time, two facts must be remembered—*a*. The results of an analysis mean nothing if the analytical work is done carelessly or improperly. *b*. The results of an analysis mean nothing unless the sample is a representative one, properly taken and properly transmitted. Of these two primary considerations the first, relating to the accuracy of the analytical work, rests with the individual analyst and we need not discuss it here. It might be well, however, to say that while some few tests can be made without much time, trouble, equipment or experience; yet the great majority require for their successful completion, considerable special apparatus on the one hand, and on the other, a worker who, by much preparation, study, and practice has been trained to this particular line of work. Mention is made of this phase of the question because some have desired this technical work in their near neighborhood. It would be desirable to have a sanitary laboratory in each thickly settled community, but as desirable a feature as this may be, it is, at present, impracticable, and one chief limitation is that of expense.

The second consideration, the reliability of the sample, is one concerning many of you for the reason that in the sanitary work in Ohio, you are occasionally called upon to collect and forward samples for examination. Experience has taught that samples are best taken in ways varying according to the nature of the analysis desired, accordingly printed instructions have been prepared by the State Board of Health for your guidance, and, to insure an analysis with reliable results, it is essential that those printed directions be properly carried out.

As an illustration of how carelessness in this regard can modify the results, let me repeat for the benefit of those not present at the last annual meeting of the State and Local Boards of Health, an instance quoted at that time. A sample of spring water had been collected in a dirty beer bottle and sent in for examination. That sample contained 23,550 bacteria per c. c. A second sample from the same spring was ordered at once, in a sterile bottle, and its analysis showed 25 bacteria per c. c. The first result was worthless, the second trustworthy, and the difference was the fault of the container and not of the water, although under ordinary circumstances the water would have received the censure. In a similar manner the use of a bottle in which there had been ammonia would greatly change certain analytical findings in a chemical analysis. Again the taking of a sample in a jug previously used for vinegar, molasses or what not, would make the sample no longer a truly representative one. A diphtheria swab rubbed in various recesses of the mouth or throat aside from the affected areas, and then, possibly, laid on a dusty table or window sill, would hardly be called a desirable specimen, and yet such has been the mode of operation in some cases. If it is desired to know by

analysis something of the character of a river water, it would be unfair to collect the sample immediately below the point where a sewer contributes its contents to the stream, and before thorough mixing of the sewage and river water has occurred. While the transportation of samples of water for a bacteriological examination may not be an ideal feature, it is at present a necessary one, and, accordingly, the shipments should be uniformly on ice. Otherwise, under favorable conditions of time, nutrition and temperature, the number of bacteria will greatly change in transportation, and this numerical change has again indirectly some bearing on the qualitative analysis. The foregoing are not the only probable errors in the handling of samples, but they may be taken as suggestive and do represent some of those most frequently encountered. Thus we see that in order for the results of an analysis to mean anything, the sample must be a representative one, properly taken, transmitted and analyzed.

Time and place make it inexpedient to give a treatise on the interpretation of analytical results, but doubtless it will be helpful to some, if a few words of explanation be given, especially in connection with some of the analyses being made for you in the laboratory of the State Board of Health.

Bacteria are living organisms, which, though minute, have the power of rapidly reproducing more of their kind, and, thus, while it can be said that the result of an examination rarely, perhaps never, hinges on the presence in the specimen of a single bacterium, yet, the finding of one of the organisms known to be the cause of a specific disease, makes the result a positive finding and brands the source of that specimen a menace to health. Although it is true that in some instances the bacilli of diphtheria have been present in the throats of persons giving little or no clinical symptoms of the disease, nevertheless, some of those mild cases led to severer ones and finally to those typical from the clinical point of view. The cries of the few on interference with personal liberty are of far less moment than the possible interference with not only the liberty but the life of the many. Our recent smallpox records furnish a striking illustration of this spreading of a loathsome evil because the mild cases were so mild as to be thought harmless, or to be called chicken-pox, Porto Rican skin disease, etc., etc. As some of you are aware, there were typical cases of confluent small-pox appearing in the wake of the so-called chicken-pox and imported skin trouble—a curious phenomenon, indeed, if the initial cases were not in truth small-pox, though trying to travel in disguise. Thus it is, that the welfare of the community demands the restriction of those persons known to possess in or about them the infectious or contagious element of a disease, whether the attacks are mild or severe.

While a positive result in a bacteriological examination is definite, and something to which full credit should be given, it is apparent that a negative result is neither so definite nor so valuable, and should not necessarily be relied upon as final. When one remembers that bacteria are sometimes but sparingly present in disease; that there is some uncertainty at times as to the exact point from which the specimen should preferably be taken; that there are natural and possibly artificial agencies at work to destroy these unwelcome invaders; and that these bacteria are of such miniature size as to require in some species 12,000 placed end to end to reach an inch, or twice that many if placed side by side; when one remembers these points, it is easy to see that stranger things have happened than the obtaining of a negative result in an examination of a specimen under combination of adverse circumstances. It is surprising that there is such a low proportion of negative findings. While in the majority of cases the negative finding is probably correct, yet, in cases still suspicious when the negative report is received, a second and even a third examination should be requested.

The quantitative bacteriological examination of water: There is a tendency to rely too fully upon the mere number of bacteria in a water. This should not be

done, for the character of the bacteria is of far greater value than the record that a certain number of them are present. The quantitative analysis is of value in this way—with other considerations remaining the same, the fewer the organisms present, the better the water; and again, a higher number of bacteria may be taken as indicating pollution of the water by substances containing the bacteria themselves, or, the introduction into the water of organic matter suitable for the sustenance and propagation of microbic life.

The qualitative bacteriological examination of water: Perhaps in no other branch of sanitary work have reports been so frequently thrown aside as worthless by the uninformed person as here; and yet this process yields a more valuable information than the one just discussed. The qualitative bacterial analysis of an ordinary water, if completely carried out, would involve weeks and even months of time and an enormous amount of labor. Every separate species would have to be isolated and identified, which would necessitate cultivation processes, taking much time. Many of these species would be found harmless water or soil organisms, and for this reason, it is practically never that a complete qualitative bacteriological analysis of a water is made from a sanitary standpoint. Instead, we look for the harmful organisms or those whose presence may be taken as a danger signal. Among bacteria, as in the higher forms of plant life, certain species possess similar characteristics, enabling us to place them in families or groups. Thus we have the group of pus producers or pyogenic bacteria, the cholera group, the colon group, etc., etc. The organism known as the *bacillus coli communis* stands as the type for the colon group; and, as its normal habitat is the intestinal canal, we take the presence of the colon bacillus in a water as evidence of the fact that intestinal discharges have reached that water. If a water receive intestinal discharges, then it is liable to contain the typhoid germ, provided there are any typhoid discharges in the pollutions reaching the water, since typhoid bacilli are known to be given off in the feces and urine of typhoid patients. Frequently a water is suspected of causing typhoid fever and a sample is sent in with the expectation that the bacteriologist can, by a few maneuvers of his magic microscope, see floating around in the water the much-talked-of and much-hated *bacillus typhi abdominalis*. As far as the writer has been able to learn there is but one man in the world who claims to be able to perform this feat, and he is a physician residing somewhere in Tennessee. Now, since typhoid germs pass from a patient in the waste discharges from the body, which also contain the colon organisms, and since the presence of fecal matter in a water makes the use of that water for domestic purposes a possible source of danger, then, the finding of either the colon or the typhoid organism is sufficient to stamp as unsafe the use of that water in a raw condition. Furthermore, the colon bacillus is far the more likely to be found in a polluted water for the reason that it is the more persistent of the two. All fecal discharges are likely to contain considerable numbers of colon organisms while the typhoid members are found only in the waste discharges of people suffering from typhoid fever, and may be but sparingly present in any given passage. If the typhoid pollution of a water supply should chance to come, as it may, from a single typhoid stool, there would elapse several and possibly many days before the realization of an outbreak of typhoid fever in the neighborhood would lead to an investigation of the water supply. During the interval of time between the pollution and the examination of the water, the probabilities are very good for the disappearance from the water of the typhoid bacilli introduced from that one stool, but the probability is very much less for finding no colon bacilli in that water. You will therefore see there is a reason why the reports on the examination of suspected typhoid waters sometimes make mention of other organisms, and yet say nothing of the typhoid bacillus. This question of practicability in the analysis is in no wise to be con-

sidered indicative of any uncertainty as to what the specific etiological factor of typhoid fever is or as to whether it occurs in water. *Bacillus typhi abdominalis* is a well known organism; it is the real cause of typhoid fever; it does get into water supplies; and it has been obtained from polluted waters by bacteriological methods.

Chemical examination of waters: The chemical examination of a water rests on a somewhat different footing from that just discussed, for, while the objects dealt with in the bacterial process are the living ones capable of causing much increase of self, the substances sought in a chemical analysis are rather to be considered as inert and not productive of any increase by self-multiplication. It should be clearly understood in considering the chemical results of a sanitary analysis that the substances reported upon are rarely present in even a grossly polluted sample in sufficient quantities to be of themselves dangerous to health, but are considered rather in the sense of being indicators of the kind, extent and condition of the pollution. It takes but a moment of reflection for us to realize that all impure waters are not equally dangerous, and that the danger is dependent primarily upon the nature of the polluting substance and secondarily upon the extent and condition of the same. As an illustration of the fact that the amount found of a substance is not itself disastrous to health, take a sewage polluted water in which the chlorine is reported as thirty parts per million. Assuming, as is probably true, that the chlorine is combined with sodium as sodium chloride or common salt, this would be equivalent to approximately fifty milligrams in a liter, or less than one grain of salt in a quart of water—not enough to make it taste good. No one would think of saying that amount of salt was injurious, for we take in our food far higher proportions of sodium chloride. The presence of that chlorine does mean, however, that salt is present from sewage, and if salt, why not disease producers from the same source. Then let me repeat; the findings, in a chemical sanitary analysis are viewed, not for the actual quantities found of the substances present, but in order that the amounts of these substances may indicate to us the character, extent, and condition of the pollution.

There are in the minds of many people two errors which ought to be corrected. These are, first, the idea that the analyst forms an opinion of a water by comparing his results, item by item, with some set table or standard of purity, and then condemns the water if the sample fails to meet the requirements of the standard; and, secondly, the idea that the analyst can, from his results alone, without any information as to the source from which the sample came, express a complete and unqualified opinion on the potability of the water. In reference to these erroneous notions let me make a few statements: There is no one standard of figures by which all waters can be correctly judged. There is in nature no such thing as an absolutely pure water. All natural waters contain more or less impurity, and the extent to which the figures expressing the determination of our indicators may shift before a water is called unsafe, depends largely upon the nature and source of impurity; accordingly what is permissible in a water of one origin might be unqualifiedly condemned in a sample from another source. For example, the average amount of chlorine found in the Muskingum river below Zanesville during the eight months of the 1899 river work was 9.6 parts per million. The water passing that sampling point has, at some time in its course, received the sewage not only of Zanesville, but of Newark, Mt. Vernon, Mansfield, Wooster, Massillon, Canton, Uhrichsville, Dennison, Coshocton, Cambridge and other minor points. While the river water below Zanesville contained, as stated above, 9.6 parts of chlorine per million, an examination last May of the water from the deep wells furnishing the public supply for the city of Massillon showed the presence of 10.4 parts of chlorine. The adoption and use of the deep well water by the city of Massillon had by practical demonstration shown the same result as indicated in the

report given of the analysis, viz—a very healthy water for drinking purposes. It would be an absurdity to condemn such a sample as the Massillon one, because it showed a higher proportion of chlorine than the sewage-bearing river water below Zanesville. In the one sample, the chlorine was in the form of common salt derived from mineral deposits in mother earth, while in the other case, it was the same chemical substance, but due largely to the presence in the water of objectionable discharges from human beings. A proper consideration of the chlorine factor in an analysis requires information as to origin, and it matters much whether the chlorine comes from the proximity of large bodies of salt water, from mineral deposits, from the effluents of certain manufactories, or from sewage. The day is near at hand, if not already here, when every analyst will flatly refuse to express his opinion upon a water of which he knows nothing of the source, collection and transmission. You would hardly expect a judge at a poultry show to score a Buff Cochin cockerel on the points laid down for Pouter pigeons. Neither should a deep ground water be classified on exactly the same lines as a surface water, for each has its special features. Furthermore, the character of the same water may vary at different periods. While samples from the same well are usually more or less constant in character, a brief glance at the table of results in a piece of river work covering several months, reveals very plainly to how great an extent the constituents in a surface water may fluctuate under the influence of the agencies of weather, seasonal changes, and a multitude of varying pollutions.

Now and then a sample is received which the analysis shows to be exceptionally good or exceedingly bad regardless of the source of water, but the great mass of samples occupy an intermediate position, and, then, every separate point in the information derived from outside sources helps, with the analysis, to a clearer solution of the question, "Is this a safe water to use?"

In closing then, I will give very briefly a summary of some of the more general points in viewing the results of a chemical sanitary water analysis, with the understanding that I may for brevity speak in generalities and that there are technicalities which very slightly modify some of the statements.

The physical characters, color, odor, sediment and clearness or turbidity, are the properties most apparent to the consumer, and are for that reason the cause of much vigorous kicking from him, when the water is not wanting in these particulars. Of course, each of these characters is best absent, yet a water objectionable in any of these respects, is not necessarily a danger to health, while on the other side, many a water physically perfect may be reeking with detrimental pollutions.

Organic matter. The purification of nitrogenous organic matter is one of oxidation through various stages from the undecomposed organic matter to a mineral condition. We speak of the indicators of those successive stages as nitrogens in the form of albuminoid ammonia, free ammonia, nitrites (nitrous acid), and nitrates (nitric acid). Hard and fast lines cannot be drawn here, but roughly speaking, recent vegetative pollution is shown by high results for albuminoid ammonia; recent sewage, by high figures for free ammonia; and past pollution, by high nitrates. Nitrites are considered as representing the step intervening in the change either way between the ammonias and the nitrates. Nitrites indicate transitional changes and any appreciable amount is undesirable. Without necessarily causing condemnation, the free ammonia may be high in certain waters from the reduction of nitrates (as in deep waters in the presence of iron with insufficient oxygen), or from the presence of ammonia salts. Peaty waters may also be high in ammonia. In general the nitrogen determinations may be taken, as a measure of the time and distance of the pollution, versus the oxidation and purification.

The oxygen required is taken as an indicator of the amount of the carbonaceous organic matter present, and is apt to be high in waters containing vegetative substances.

Mineral characters. Considerable chlorine may be present if it is known to come from an unobjectionable source. Chlorine of sewage origin is objectionable. The combined alkalinity and incrusting constituents give approximately the total hardness; the former representing the carbonates and bicarbonates, and the latter certain sulphates, chlorides, etc., which form the permanent hardness, or more properly speaking, the scale forming element best known to those who use hard waters for steam purposes. Too low an alkalinity is not desirable, especially if the water is to be treated by filtration in which an alum or similar coagulant is used.

The total solids may, except in waters containing much suspended matter, be taken as a general indicator of the total mineral constituency in the water and should not be too high.

In the foregoing remarks there has been necessarily an omission of much that is of great importance in the consideration of an analysis and the interpretation of the results; but we trust that some few points will be clearer, and that as we join hands in working together for the one cause—the improvement of the health of the people of Ohio—we may understand one another better and thus accomplish more efficient work.

The President—Gentlemen, this paper is before you: are there any remarks?

Dr. A. J. Baumhardt, Lorain—I see Mr. Horton has omitted one part of water analysis which we consider important. That is the animal experiment. We take a part of the sample and cultivate the culture in a brood oven at the temperature of the body. At the expiration of 24 hours we inject one cubic centimeter into a white rat, or use perhaps a half dozen rats. If there are any micro-organisms there they will grow at the temperature of the human body. If there are any in the water the rat will die in 24 to 48 hours, and we then make a culture from the intestines, etc., of the rat, and in this way have often been enabled to condemn dangerous water which otherwise might escape detection. We had a sample from a place afflicted with 300 cases of typhoid fever, where we made the test and found the organism without knowing that typhoid fever existed at the place from which the water was taken.

Mr. Miller—I would like to ask a question. In case of a township where there is a board of health, containing a village which has no board of health, what step is to be taken in case of outbreak of disease in that village?

The President—The township trustees, by virtue of their office, will control the village if it is not incorporated.

(Question restated.)

Dr. Probst—The law gives the township trustees authority outside any incorporated village. The law provides that every city and village shall establish a Board of Health. In case they don't, then you can call on the State Board of Health, which may act in such cases.

Mr. Miller—Another question,—where a Doctor has a case of diphtheria and does not report, what is to be done?

The Chair—He has twelve hours in which to report. If he fails to do it you have the right to arrest him and have him fined. Are there any further remarks on the paper of Mr. Horton?

Dr. Howland—The gentleman who spoke awhile ago said something that I cannot quite agree with. He said that Lorain had the purest water in the state. I reside in Plain City and we have there an artesian well which was discovered in boring for gas, which extends about 400 feet below the surface. We erected a water tower there and send that water to every part of the town. Since the establishment of that water system, we have not had a single case of typhoid fever where the person used the water from the water works. That would probably indicate that we do not need any filter, tho' I believe in filters, especially where river water is used.

Dr. J. E. Foster, Coshocton—While on the subject of typhoid fever, and to a certain extent on the subject of bacteriology, I would like to ask Professor Horton the natural habitat of some of these bacteria, as bacillus tuberculosis, lepra bacillus and bacillus tetani, or the bacillus which produces tetanus. Also if the germ of tuberculosis depends for its existence upon the disease which it produces in mankind and in animals. If this were true as to the germ which produces tetanus, I do not think we have enough of the disease to perpetuate the germ, and I wondered if this might not be the case with some other germs.

The Chair—If those who wish to take part in this discussion have spoken, Mr. Horton will close the discussion and answer the questions.

Mr. Horton—In relation to what Dr. Baumhardt said regarding animal inoculation with water, I do not for a moment depreciate the value of that test, but, as you will remember, I referred to those examinations in my paper; but it is practically impossible to carry it out in the tests made by this department. Notwithstanding the appreciation the State Board of Health has for the work of my department, I think if I had put in a bill for three or four hundred dollars for animals, there might have been some objection. And I am afraid it is more than you can ask one man to do in 18 months, to make 911 analyses, making that many cultures and inoculating so many rats, holding autopsies on the same, and so on.

Regarding the natural habitat of these germs, I wish I knew where all these germs came from, but I don't. There are certain germs which do have a natural habitat; for instance, the colon bacillus or organism is supposed to belong to the intestinal tract, and there are bacilli which belong in the dirt, the soil. But in the case of diphtheria or the typhoid germ, we do not know where they come from. Regarding tuberculosis, as far as we know the bacillus tuberculosis does not grow outside of animals, unless by special cultivation.

A Member—In regard to the contamination of milk, if you get tuberculous milk, can you, by heating to a point lower than boiling, kill the germs?

Mr. Horton—Recent researches have shown that it is not necessary to heat to the boiling point.

A Member—As low as 170° ?

Mr. Horton—Yes.

A Member—The proposition is that the boiling of the milk renders it less easily digested and spoils the flavor.

Mr. Horton—The old idea was that it had to be boiled, but recent research has shown that heating for 15 minutes at a temperature considerably below the boiling point makes it all right. I might say that spore forms are very resistible and not always killed at a boiling temperature. The tetanus germ is one of the organisms which forms spores and you would have to heat that to the boiling point or a higher temperature.

The following resolution was presented by Dr. W. A. R. Tenny of Cincinnati:

“Resolved, That it is the sense of the Tenth Annual Convention of the State and Local Boards of Health that the bill read before it by Representative Dr. F. W. Hendley of Cincinnati, Ohio, providing for the disinfection of school houses be heartily approved, and that a committee of three be appointed by the chairman of the convention to confer with Dr. Hendley, with authority to determine as to the details relative to the manner of providing funds by Boards of Education or Health Boards, and the conditions which should obtain to make it necessary for such disinfection.”

Dr. Smith, Cincinnati, moves the adoption of the resolution.
Seconded: carried.

Dr. W. A. Daugherty, Bucyrus—Knowing as we do the bad effect of cigarettes, and as a member from Cleveland has introduced into the Legislature a bill regulating the sale of the same, I move that the State and Local Boards in session instruct the State Board of Health to endorse that bill.

Seconded.

Dr. Cox—I do not think the local boards should tell the State Board what to do. If they want to endorse them, let them do it, and not have the local boards say they should do it.

Dr. Daugherty—The reason I put it in that way was to let the State Board know they have the endorsement of the local boards in the matter.

A rising vote was taken upon the question and same carried.

Thereupon the meeting adjourned until the evening of the same day.

THIRD SESSION.

THURSDAY EVENING, January 25, 1900.

The President called the meeting to order and introduced the Governor of the State who delivered the following address of welcome:

The Governor—Mr. President and Gentlemen—I believe I am brought here for the purpose of making an address of welcome. There is always one good thing about an address of this kind,—it is expected to be short. This is good for you and I like it also.

I understand that you compose the boards of health of the State of Ohio. I welcome you to Columbus, because I think you have one of the most important duties to perform of all the officials of the State of Ohio. Of course, the public health is of the very greatest importance to our people and to the State. It has often been said that an ounce of prevention is better than a pound of cure. Now, it is your peculiar duty to look after the public health, not only to see that it is preserved but also to take precautions that diseases shall not come upon the community, and to protect the health in advance of every great danger threatening. Now, I cannot imagine any duties that any officers have to perform which are more important than this one. The happiness of the State, the happiness of our homes and the happiness of all of us depend upon this duty being well performed.

I understand that you have met together in this convention for the purpose of consulting with each other as to how you may best preserve the public health, what means you may adopt for the preservation of it. It is upon this splendid mission you are assembled, and in the performance of these duties, I welcome you most heartily. I welcome you in the name of the people of the State: I welcome you because I believe you are determined to well perform this duty which is of the very greatest importance to the happiness of all our people.

Gentlemen, I thank you for your attention. (Applause.)

The President—Your Excellency: On the part of the Boards of Health of Ohio, and as President of this convention, it is my first duty to thank you for your good and generous words of welcome. It is indeed reason for congratulation that the sacred cause of Sanitation has the sympathy and co-operation of the Chief Executive of our cherished State of Ohio. You will also readily understand the reasons for the quick appreciation which those present would have for the good words you have said for our cause, and for the present hopeful condition of that cause in Ohio.

It is a wonder that it is as it is. For the cause of organized preventive medicine is only fourteen years old in the State of Ohio. It is indeed cause for surprise that, in the State of Ohio, where such tender care is taken of the helpless classes, the insane, the blind, the epileptics, etc., spending millions of dollars preparing homes for them, and hundreds of

thousands of dollars every year in maintaining them, that, until a few years since, the authorities never thought of spending one cent to prevent the people from converging upon the roads leading to these institutions; to prevent disease among the well, upon whom the State must ultimately depend. In regard to present conditions, and not desiring to trust my memory, I have prepared the following statement:

The Ohio State Board of Health was created by act of legislature, April 14, 1886. Ohio was the thirty-second state to establish a board of health.

Idaho, Montana, Oregon, Wyoming, Arizona, Alaska and Indian Territory have no boards. A bill to establish one is now pending in legislature of Georgia.

The Ohio Board, from the beginning, cultivated friendly relations with the medical profession whose members have always been foremost in urging sanitary reforms. Voluntary reports of the prevalence of dangerous contagious diseases, reports upon the sanitary defects of our towns, and other information of use to the board have always been furnished by physicians.

The board early saw the need of having an active, organized sanitary force in the field, as there were but few local boards of health. Various amendments to the health laws were secured, until the present law was enacted in 1893. It not only provided for a health board in each municipality and township, but greatly increased their powers. The act creating the State Board of Health was also changed and strengthened in many particulars.

The constant aim of the State Board has been to cultivate friendly and helpful relations with the local boards, and at all times render them all the assistance in its power.

A sanitary bulletin was started in 1888 and has been continued to this time, with the exception of a short interval when meager appropriations made it necessary to cut off this expense. The bulletin has offered a medium of communication with local boards, and others interested in sanitation, and has enabled the State Board to furnish health officers and members of boards of health with the latest published accounts of disease-preventing measures. It has also enabled the board to place in their hands the proceedings of the annual conferences.

The dissemination among the people of information concerning measures for the prevention of various contagious diseases by means of appropriate pamphlets has been persistently carried on.

In 1890 an invitation was extended to local boards of health, to send delegates to a conference of the State and Local Boards of Health, to be held in Columbus. About sixty persons were present. For the past four or five years the attendance has been three hundred and over.

The Board also held a conference with superintendents of public schools when topics relating to school hygiene were discussed. Another conference was held with the State Funeral Directors' Association to discuss the precautions necessary in dealing with the preparation and burial of persons dying of contagious diseases.

The board has taken an active part in the Conference of State and Provincial Boards of Health of North America, our secretary having been secretary of that organization for nine years.

It has also contributed its share in the work of the American Public Health Association, of which Dr. Probst is also the secretary.

Speaking of our secretary, it is due that something be added to that which I have read. "A prophet is not without honor save in his own country," comes down to us from high authority. Happily I can say that Dr. Probst's country is guiltless of this species of injustice. I have fre-

quented the national health bodies a good deal and know that he is universally classed with the first sanitarians in this country. The places of honor and trust accorded to him prove that fact unmistakably. Nor is it too much to say that by his great ability, and by his self-sacrificing efforts in behalf of the welfare of the people, he has won a high and lasting place in the grateful appreciation of the people of Ohio. I say this not to praise Dr. Probst—such a thing has no proper place here—but because any such outline as I am endeavoring to present to you would, without this much, be most lame and unjust.”

Since the law of 1893, requiring the board's approval of sources of public water supplies and sewerage systems, 159 communities have appeared before the board with plans to be acted upon.

Investigation of rivers was begun in 1897. We have now completed the Scioto, Olentangy, Mahoning, Maumee, Sandusky, Muskingum and all their tributaries, and will soon be able to furnish a complete report on the condition of all streams in Ohio. The gaging of streams, in connection with the United States Geological Survey, has constituted a part of this work.

The law of 1898 requires the board to report upon the condition of all public water supplies. The board's engineer has visited all water works in Ohio. The condition, capacity of pumping machinery, source of supply, sources of pollution within ten miles of intake where streams furnish supply, location of sewer outlets, and other information relating to the water supply is shown in the engineer's report, being published in the annual report of the board for 1898, now going through press.

The laboratory was opened in July, 1898. Its purpose is to assist local boards in placing problems that arise on a sure and scientific foundation.

The encouragement of sewage purification, especially in public institutions where its inauguration was the least difficult, as a means of public education, along this line, is a most promising feature of the board's work.

The many communities visited by members, or the secretary of the board, to assist local authorities in controlling contagious diseases, or to abate nuisances, has been helpful. The board at one time, by committee, inspected most of the state institutions of Ohio and reported upon their sanitary condition. It was instrumental in securing legislation in enabling desirable changes to be made.

The board's growth has been recognized in the assignment of commodious quarters in the new State House addition, three office rooms and four rooms for laboratory having been given to it. It is desirable to largely increase laboratory facilities to meet demands of local boards of health.

After completing the reading of his paper, the President said:

Now, the old saying is that “money makes the mare go,” and the State Board of Health needs money for the purpose of fitting up our new laboratory. We do not need any more money for current expenses, but for the equipment of this department on a practical basis, as it should be. It has saved money to the state already. The analyses are made by our own men for less money than formerly by professors whom we were obliged to hire here and there. But we do need money to fit up a new laboratory with improved facilities, and need it, too, to complete this review of the surface water supplies of the state.

Then, there is to be our State Centennial, two years hence at Toledo, and there could be no more desirable feature at the Centennial than to show the progress that has been made in sanitation. I will refer to one department: Everybody knows that the first thing the sewer-builder thinks of, in building a new system, is to strike for the nearest running water. Owing to that practice the streams of Ohio have been threatened with contamination from one end of the state to the other. Since '93, the date of our present law, this practice has been largely abolished. The operation of the law has caused a great deal of irritation and trouble, though, as a result, we have now more sewage purification plants in Ohio than there is in any other state west of the Alleghenies. At Toledo we could arrange to present the different methods that have been employed in a row, delivering into each plant an equal amount of sewage from that institution, and this could be followed through the different stages of purification, and prove a most interesting exhibit and object lesson to the people considering this subject, and might be worth more than all the arguments of the State Board of Health. And we need a greater appropriation for the purpose of putting the reporting of vital statistics on a better foundation.

Tho' we have not had the least appropriation in the United States, I venture to say that the State of Ohio can make the best showing for the amount of money at its disposal of any of the states. Massachusetts has appropriated as much as \$160,000 a year for this department. In Ohio we have less than one-tenth of that amount. It seems that there is a lack of appreciation of the importance of this matter on the part of legislatures. If a man gets sick, or hurt, he passes into the hands of the doctor, and if that doctor cures him, he receives a good deal of credit and much cash. If he keeps on, year after year, his skillful healing of people he creates a great reputation and becomes wealthy. But let a Health Officer step in where there is a case of diphtheria or smallpox and stop it, then and there, and thus save scores of lives, nothing is said about it. Indeed, sometimes he escapes well if he isn't roundly cursed.

If sanitation makes as much progress in the coming century as it has in the last few years, the filth diseases will disappear, and our grandchildren will look back upon smallpox, typhoid fever, and consumption, as we look back on the "sweating sickness" or on "black plague" that decimated the old-world population years ago. And God speed the day: the day when man, woman and child in Ohio may live free of those diseases, and under the most favored conditions for health, happiness and long life. (Applause.)

The President—Gentlemen, the next number of the program is—a conundrum which I will not undertake to answer—"And Why Not Morals as Well?" by Dr. E. L. Rexford, Pastor of the First Universalist Church, Columbus.

Dr. Rexford addressed the convention in the following language, frequent interruptions of applause attesting close attention and appreciation on the part of the audience.

AND WHY NOT MORALS AS WELL?

By Rev. E. L. Rexford, Columbus.

MR. CHAIRMAN AND GENTLEMEN — Permit me first of all to acknowledge the courtesy of your invitation to me to come here with a brief message to your honorable body and to confess the interest and the pleasure I have in presenting certain phases of thought which hold at least a sympathetic relation with the problems which you are endeavoring to solve.

As I look upon the moral phases of this complicated interest I can see not only a sympathetic relation but an organic and very direct relation with the fortunes which you seek to promote, and nothing but ignorance or a want of appreciation would ever have divorced them.

If you had followed the historical antecedents of the medical and the clerical profession and had been influenced by the long continued hostility of the theological party toward the medical you would have been easily pardoned for not inviting any representative of the church to any participation in your work, and the fact that you are willing to do so is a noble comment on your generosity and your willingness to forgive. It can hardly be forgotten that the church has interposed many an obstacle in the way of medical science, and not a little ill feeling has been indulged by the clergy in former times over the professional art and practice of the physician. The church has been the most intolerant enemy of medicine, not in these later years it is true, but in the histories no fact is more distinctly seen. It was on the field, abundantly equipped, as it sincerely believed, for a successful warfare against pestilence and disease and death, and that long before the physicians arrived. It had its elaborate preparation of charms and relics and prayers and processions and miracles and adoration of saints, and hundreds of other barriers that it could erect in the paths of death, and claiming guardianship and direction of the supernatural powers, it assumed an infallibility that would not be questioned. And when we recall how the *Black Death*, the *Sweating Sickness*, the *Plague*, the *Cholera* and the *Fevers* swept these worshipful devotees even from their prayerful knees into their multitudinous graves in London and Paris and Rome, and hundreds of other cities on the continent we are reminded of a saying of one of our quaint American philosophers that he would rather be ignorant of a great many things than know so many things that are not true.

There are untold tragedies in the long history of human disease which from time to time has so accumulated its violence as to spread pestilence and plague far and wide; but if there are tragedies in this there is an unspeakable pathos in the spectacle of the people suffering these calamities, and at the same time misapprehending the cause and vainly resorting to false but sacred and severe methods for their prevention.

Thucydades and Lucretius and Grote have given us distressing pictures of the plague of Athens which swept away such masses of the people, and the Hebrew histories tell us the story of similar calamities among the Jews. Under the banners of Christ and the true church in the middle of the fourteenth century one half of the population of England died of the Black Death, and on the continent of Europe more than twenty-five millions perished from the same cause. In 1552 sixty-seven thousand persons died of the plague in Paris, and thirty years later thirty thousand more followed.

And over all these wretched scenes, whether among the Greeks, the Romans, the Jews or the Christians there was one shadow common to them all: it was the belief that these scourges of death were sent by the angry gods—the malice or wrath or envy of the evil spirit, or by the wrath of the one Supreme God.

Disease thus originating in the angry impulse of the deities occasioned by the sins of the people, there has been developed not only the "Theological Theory" of pestilence and plague and sickness of all kinds, but a theological method of treatment as well, and it has held sway from the time of the plague of Athens, 450 years before Christ, and how much earlier we can not tell, down to 1885, in Montreal, when the church through its priesthood arrayed itself bitterly against the board of health and the city authorities generally, to resist the vaccination of the people for smallpox that was raging fiercely among them.

And so for centuries upon centuries this religious, or pious, or sacred treatment has been pursued by the religious people, so-called, and unfortunately it would seem the religious party has been in the ascendant for a majority of the years, and rational medicine and the science of hygiene has been discounted or condemned.

Until a comparatively recent period every attempt of every man to secure a scientific treatment for human ills in the name of reason has been condemned by some man or party in the name of religion, under the certain conviction on the part of the opposition that to deal with the disease or pestilence or epidemic on natural grounds would only tend to increase the wrath of the spirits, which wrath had been the cause of the evil itself.

So late as 1847 the celebrated Scotch physician, James Simpson, incurred the enmity of the good Christians of that country by recommending the use of anesthetics in the instance of childbirth. As far away as 1591 "Eufame Macalyam, a lady of rank, being charged with seeking the aid of Agnes Samson for the relief of pain at the birth of her two sons was burned alive on Castle Hill at Edinburg; and this ancient theological view persisted even to the middle of the nineteenth century. From pulpit after pulpit Simpson's use of chloroform was denounced as impious and contrary to Holy Writ, and texts were cited abundantly to show that the use of chloroform was to avoid our part of the primeval curse upon woman." So says Dr. Andrew D. White in reporting the experience of Dr. Simpson at the hands of the Scotch theologians. The doctor wrote pamphlet after pamphlet to justify himself and finally won a great part of his victory by using a Bible argument to convince those who relied wholly on the Bible. He said: "My opponents forget the twenty-first verse of the second chapter of Genesis; it is the record of the first surgical operation ever performed, and that text proves that the Maker of the Universe before he took the rib from Adam's side for the creation of Eve, caused a deep sleep to fall upon Adam."

This was a stunning blow, but it did not utterly kill the opposition. They had strength enough left to maintain that the "deep sleep" of Adam took place before pain was introduced into the world.

In the darker days of Christianity in Europe the favorite methods of staying the pestilence were penitential processions, the display of images of the Virgin Mary or of the Saints in the plague-smitten towns or cities, the trooping of pious people through the country, scourging and lacerating their own bodies: the gifts of lands or moneys or privileges to churches, and religious institutions, or the chanting of the penitential psalms or prayers, or the invocation of the saints, or the torturing and slaying of the Jews which the pious folk regarded as perfectly consistent with other devout exercises.

This atrocity against the Jews sprang from a belief early developed in the Church that Satan sent diseases upon the people and employed the Jews as his agents, and for a consideration he exempted them from the scourges sent upon other people. It was observed that in the plague stricken cities the mortality

among the Jews was less than among others—a result no doubt of their better sanitary habits inherited from the old Mosaic institutes—and the church authorities observing this, accounted for it by supposing them to be in league with the devil, and so persecuted them, and often banished them, and not infrequently burned them. In Strasburg the Rue Brulée remains to-day as a monument to the Jews, two thousand in number, who were burned there under the accusation of poisoning the wells and causing the plague of 1348; at the Royal Castle of Chisson, near Tours, an immense trench was dug and filled with blazing wood, and in a single day one hundred and sixty Jews were burned. Everywhere in Europe the mad persecution went on.” (White.)

A similar destruction of persons accused of being witches was carried on under the belief that they were the cause of epidemics. The history of this delusion is one of the most fearful records of human depravity, upborne by religion, that the world has recorded.

Everywhere the *real cause* from which the people were perishing was missed in the search for it, and the false reasons assigned were everywhere followed by a greater misery, if possible, inflicted by man upon his fellows.

While the church was burning the witches and the Jews on suspicion of causing the pestilence she was tolerating the essential cause of the awful scourge of the people in the filth that was accumulating in the cities and towns, wherever the people lived. The pernicious idea took early possession of the pious mind that personal cleanliness betokened an unholy pride, and hence a religious premium was placed upon personal filthiness. It was a sign of superior sanctity. It was said of St. Hilarion that he lived his whole life in utter physical uncleanness. “St. Athanasius glorified St. Anthony because he had never washed his feet; St. Sylvia never washed any part of her body except her fingers; St. Euphrasia belonged to a convent in which the nuns religiously abstained from bathing. St. Simon Stylites lived in odors and stench intolerable to his visitors.

The *Lives of the Saints* dwell with complacency on the statement that when sundry Eastern monks showed a disposition to wash themselves the Almighty manifested his displeasure by drying up a neighboring stream until the bath which it had supplied was destroyed.

Nor yet alone on the Catholic continent. Reaching far on to the center of our now closing century we find Protestants and very religious Scotland indescribably filthy and charging its epidemics to “the Divine visitations.” “All that in these days that is swept into the sewers was allowed in those days to remain around the houses or thrown into the streets. The old theological theory that “vain is the help of man,” checked scientific thought and paralyzed all sanitary endeavor. The result was natural. Between the thirteenth and the seventeenth centuries thirty notable epidemics swept the country, and some of them carried off multitudes, but as a rule these calamities never suggested sanitary improvements. They were called “visitations” attributed to divine wrath against human sin, and the wish of the authorities was to announce the particular sin involved and declaim against it.”

The church authorities in Montreal in 1885 said that the smallpox that ravaged the city at that time was the punishment for the festivities that were held there in which the Virgin Mary and the Saints were not sufficiently recognized. Poor reasons enough, while the cities that burn witches and allowed filth to accumulate and the water supply to become corrupted will have the devil to pay if they prefer to call it by that name. Satan has sometimes been accused of arraying himself as an angel of light to accomplish his purposes, but sometimes I imagine the very God arrayed Himself as an angel or minister of Darkness to accomplish by violence and pestilence and death results which he cannot accomplish by the quiet and general methods of wholesome peace.

Luther called his own sickness "devil spells," and said that Satan produces all the maladies which afflict mankind, for he is the prince of death. He poisons the air, but no malady comes from God." We are not so certain of that.

Cotton Mather of our own New England said: "'Tis the devil that scatters plagues about the world; pestilential and contagious diseases; 'tis the devil who often invades us with them. 'Tis no uneasy thing for the devil to impregnate the air about us with such malignant salts as meeting with the salt of our microcosm shall immediately cast us into that fermentation and putrefaction which will utterly dissolve all the vital ties within us. And when the devil has raised those arsenical fumes which become venomous quivers full of terrible arrows, how easily can he shoot the deleterious miasms into those juices or bowels of men's bodies which will soon inflame them with a mortal fire!"

These and a thousand other utterances of the theological party made fearful by a thousand and more cruel and inhuman deeds, seem like the products of the insane mind dwelling in a world of chaos. But instead of this, the word and the deed bear the seal of approval of grave and learned councils and of high officials of religion, though the entire history appears today as a long continued perversion of the simplest laws. The history begins with a stupendous misapprehension and continues with an ever increasing mass of horrors till the scientific spirit makes new discoveries, breaks over the ecclesiastical barriers and wins its victories in behalf of a natural understanding of the world, and the laws that make for human happiness and well being.

The world is to be congratulated that the wrath of the gods is gone, and that we can account for fevers and pestilence, and a good many other things without the devil, the word of Luther and Cotton Mather to the contrary notwithstanding. We have come to see that a fever is a benevolence, that an epidemic is a greater benevolence, bearing to us the message that something is wrong and needs to be corrected. Where today is the yellow fever scourge of Memphis and New Orleans, and even of Philadelphia and New York, and Mobile and Savannah? It no longer exists for the reason that God kept telling the people by the silent lips of death what they would not heed when told by the living, and then the people understood, corrected the evil conditions, removed the cess pools from the southern cities, introduced wholesome systems of drainage, and the story of benevolence was completed in the good health of the people.

Down to the sixteenth and far on into the seventeenth century the filthiness of the average English life was indescribable. The very floors of houses that had floors, were inlaid with the germs of disease. Erasmus writing to the physician of Cardinal Wolsey describes this wretched condition and tells him that if he steps into a room for a little time unoccupied he is seized with a fever, and one of the old English Chronicle tells us that the floor of Queen Elizabeth's presence chamber was covered with hay "after the common custom." Kious, and Mead and Pringle at a later time urged sanitary reform, but the theological spirit was too strong and little was accomplished. The religious methods with disease prevailed and as a result in 1665 the plague swept out of London over one hundred thousand victims, and the ecclesiastics said that it resulted from a profaning of the Sabbath.

In France a similar history is recorded. Generation after generation was scourged and decimated.

The chronicles of the plague at Marseilles at the beginning of the last century are horrible in the extreme. They speak of great heaps of the dead in the public places "forming pestilential volcanoes, of plague stricken men and women wandering naked through the streets, and of the death roll numbering at least fifty thousand out of a population of ninety thousand.

But England and France have been rescued from the theological party by the hygienic party, and these horrors are no longer repeated. Spain and Italy

have been largely rescued in the same way, and the terrors of pestilence and the plague have been abated.

The people have discovered through their sorrows and through the terrors of pestilence how to work with God, or in other words, they have learned the laws of health and have mightily moved in the direction of right sanitary conditions, and as a result life has become more rational and secure. And if I wished to compile a list of the world's benefactors I would seek for its larger part among the men who have labored to give the people a right understanding of the laws that govern the health conditions of the personal and the public life. From such a calendar of saints we could hardly omit the names of such men as Bigelow and Bartlett, and Forbes, and Boylston and Bowditch, and Probst in this country, and Ehrenburg and Cohn, and Lister, and Pasteur, and Koch, and Billings, and Bering, and Pinel, and Tuke, and John Howard, and Simon, and rising to great prominence among them, the late Edwin Chadwick, whose address at the Sanitary Conference at Brighton in 1888 must be a living gospel for many a year to come. And I would not wish to omit from my list the name of John Ruskin so recently gone. He wrought in another part of the field, 'tis true, but he wrought well for the good of the people.

These and many others like them are entitled to easy places in the calendar, easy when compared with many others whose names are already there, but whose virtues not to be compared with these who have wrought so happily for mankind.

We have discovered through these men and their co-laborers that more is involved in their findings than the physical health of the people.

John Wesley said that "cleanliness is near akin to Godliness," and it is equally true, I think, that low moral conditions are most at home in the midst of physical depravity. People who can accustom themselves to ease and content in the midst of filth can not cherish any very high ideals of moral, social or intellectual life. The Christian scriptures ask the question: "Know ye not that ye are the temple of the living God?" If the temple is filthy the worship at the altar will not be pure. A filthy city will not be a moral city. While a clean house will not of necessity be a virtuous house, yet the higher graces of life have a better promise of growth there than in a house of uncleanness, and the consequent bad odors. The olfactory nerves naturally protest against stench, the optic nerves protest against deformities, and the auditory against discords, and any abuse of nature that will break it down and drag it with a measurable content with unsightly, discordant and disgusting surroundings so that disgust is no longer disgust is necessarily a demoralizing thing. Depravity is contagious. It does not confine itself to a single department of human nature, but breaks over the dividing lines and invades the whole.

In the modern processes of rationalizing human life we have found that there is no fact, interest, department or profession or occupation that stands alone, separate and by itself. Nowhere in nature is there any isolated or alien fact. Everything is related to everything; everything depends on everything, and no profession can any more step aside and say, "I am sufficient unto myself," than one star in the heavens can sever its relation with the other stars and say, "I can hold my place without any bonds with other stars."

No one condition of the public life can be severed, neglected or forgotten without affecting other conditions.

It is not in the province of this paper, perhaps, to criticise any class of men, and yet I deem it permissible to say that the clerical profession has so long neglected this world in preparing people for the next that their report of that next world is half incredible on account of their poor judgment of the world that needs it.

The simple fact is and ought to be the unforgettable fact, that this world is connected with whatever worlds may be hereafter, and the most important world for any man at any given time is the world he is in. This earthly life is not an alien from the commonwealth of the Almighty, and to care for the laws and right conditions of this world is quite as important as to care for any other. There are problems in Columbus and Cincinnati today more difficult to solve than any presented by the New Jerusalem, unless we mean by the New Jerusalem the redeemed cities of this world in which it will be safe and delightful to live.

This process of human redemption legitimately begins with the bodily conditions. There is a festering mass of humanity within three squares of where we are sitting at this hour that needs soap and water, the hose of all the engines in this city turned into the wretched and filthy dens—these far more than they need bibles and hymn books. The Bad Lands of Columbus interject a note of discord into all the sermons preached in the churches adjacent to them. Thus humanity rots in its filth and its crime while the owners of the wretched hells sit in the pews of churches near by pluming their wings for the flight to heaven under the direction of their spiritual guides. I know it were better for the ministers to advise their celestially expectant members to fold the rising wings and shut out the vision of paradise for a time, seek an introduction to the health boards and then say to the owners of the Bad Lands: "You must clean out these hells before you can go to heaven and chant the Lord's songs. You cannot enter a heaven whose gates were opened by self-sacrifice if you approach them from the miseries you have fostered by a greed of gold that was willing to speculate and grow plethoric on the frailties and weaknesses of your human fellows."

A higher appreciation of the divine values of this present world is what the church has always needed and what it needs now. Pure food, pure air, pure water, clean cities, clean homes—these are among our primary necessities, and these secured we shall find your hearts and minds an easier possibility.

There may be people like Lady Macbeth "who need the divine more than the physician," but there are multitudes whose necessities reverse this order, and until the physician can do his work the divine will have a poor promise of success.

These interests are so closely related that the ministers and the doctors ought to know each other, and the churches and the boards of health ought to be on intimate terms.

Clerk Maxwell, a few years ago before the Scientific Association at Toronto, urged the advantage of cross-fertilization between different allied types. I am certain that a similar process carried on between the several professions, and notably between the medical and the religious, would result in larger benefits to the several interests involved. If we will bear the vastly accumulating fortunes of the public life to higher grounds in our advancing civilization it must be by the combined efforts of the various professions and industries which heretofore have occupied separate and sometimes hostile fields. Our secularism needs sanctifying and our piety or religion needs a larger infusion of a saving common sense. We need more examples of good judgment, such as the Philadelphia clergyman gave the country in 1893. His Bishop had issued a common call to prayer for all his clergy to ward off the cholera which was threatening. This clergyman refused, and said that to respond to the call while the streets of Philadelphia were so filthy would be blasphemous.

It was an echo of the conspicuous wisdom of Lord Palmerston in his reply to the Presbytery of Edinburgh in 1853. The cholera was threatening Scotland, through the provocation of unsanitary conditions. The Presbytery of the capital instructed their moderator to write the Prime Minister of Great Britain asking him if the British government did not intend to appoint a day of fasting and prayer for the prevention of such a calamity, saying that they had refrained from appointing a day

to be locally observed, thinking that a National appointment would be more influential.

Lord Palmerston who knew that the sturdy sense of England would sustain him, wrote a letter in reply which shows the entire severance which had been accomplished in his mind between the theological and the scientific methods of dealing with such problems. The Presbytery of Edinburg were informed that the affairs of this world are regulated by natural laws, on the observance or neglect of which the weal or woe of mankind depends. One of these laws, said Lord Palmerston, connects disease with the exhalations of bodies, and it is by virtue of this law that contagion spreads. Man by exerting himself can disperse or neutralize these noxious influences. The appearance of the cholera proves that he has not done this. The towns have not been purified; hence the root of the evil. The government therefore advises the Presbytery of Edinburg that "it is better to cleanse than to fast." "Activity is better than humiliation." He told them that the filth of their cities would, if not removed, breed pestilence, "in spite of all the prayers and fastings of a united but inactive nation."

These are sentiments of whose kind we are destined to hear many repetitions in the century that is opening before us, and when their rationality shall possess the mind and heart of the people we shall realize that this is a very good world in which to live if we will make it so. We may not well forget that there are other worlds, but they will wait for us while we are yet busy with the tasks of this. It were better that the eternities should wait as so many fragments if our purpose shall be to make the hour that now is complete.

The President—I think I can assure Dr. Rexford, on the part of the Ohio Boards of Health, of our very sincere thanks for his splendid address. (Applause.)

The President—About two years ago some evil influence took its flight across the western counties of this state, spreading smallpox on the way. Everyone knew there was a "nigger in the wood pile," and it proved not to be a slang expression in this case, as on tracing the matter up they found that a colored man in a company playing "Uncle Tom's Cabin" was sowing smallpox all over these western counties. Dr. Marchand will discuss this subject in his paper, "What the World Owes to Vaccination." Gentlemen, you need no introduction to Dr. Marchand.

WHAT THE WORLD OWES TO VACCINATION.

By J. F. Marchand, M. D., Health Officer, Canton.

The discovery of vaccination by Jenner, and the test which it has stood for one hundred years, is to me the greatest discovery ever made for the benefit of the human race: inasmuch as his discovery was the result of induction rather than discoveries now made in the medical profession by means of deduction.

Vaccination was not a discovery, nor an invention, but it was more. In the language of Mr. John Simon, it was—"A matchless piece of induction."

Nay, it was even more than human power or possibility at this time. In the providence of God, great measures and great men are co-incident; and if Jenner is to be rightly placed in the category of the world's heroes today, I would place him high up, over all, upon the pinnacle of fame in the world's gallery of illustrious men; because he had brought light out of darkness and sunshine out of chaos, in the work of his early life in saving human life and preventing pestilential disease.

Widely contrasted in greatness is this hero from those whom the world worships today.

Other heroes have slain their thousands and tens of thousands by the dreadful implements of warfare devised by the ingenuity of men, in the different periods of the world's history; but he has saved from terrible death millions in every land; and his life's work has brought peace and happiness to all people, and is still going on throughout the entire world.

The various agencies and methods which enabled Jenner to reach his conclusions and publish his theories regarding all that he claimed for vaccination, now seem rather accidental or providential, than logical conclusions. It is an old adage that "knowledge is power." But he did not possess even this, regarding the nature of contagious and infectious diseases. Under such circumstances, with no knowledge or conception of the germ theory, it is really to be wondered how so great, lasting and beneficial discovery could have been made. Too long had the world measured greatness by the outgeneraling and outmarshaling in force of arms.

The price of heroism was paid by human blood. The victor's crown was worn by men scarcely raised above the brute creation.

The disaster of wars was not equal to the deaths from smallpox. The ravages from this disease alone were so alarming, that the entire population of cities and countries everywhere was threatened with annihilation.

The discovery of vaccination and its practice, called the first halt upon smallpox; and its potency today is the only safeguard that we have in preventing smallpox.

The success of vaccination, as enunciated by Jenner, formed a nucleus for the medical profession to begin operations in preventive medicine. Its discovery alone did more than any other one thing for sanitary science. It concentrated medical thought upon the true nature of contagion. It broadened the medical horizon at a new epoch in the world's history. It helped to lift medicine out of empiricism. It started a new sanitary science. It furnished material for subsequent work in the evolutions of boards of health. It proved to the world that disease can be prevented, or, at best, modified. It demonstrated higher ideals for the human family than conquest of men and lands. It proved conclusively that Providence was not guilty of that for which He was charged, in visitations of death and disaster by this enemy of mankind. It placed within human hands methods and means for the obliteration of smallpox. It has made the history of the disease which for more than two thousand years nothing could be done whatever, a disease entirely within control and modification. It has removed a scourge from the face of the earth. And by so doing I am not too prophetic in predicting that the other scourges which menace the race await similar solutions at our hands.

The history of smallpox prior to Jenner's discovery, makes a sad and gloomy picture. The completeness or incompleteness of its history up to this time is the most terrible record of disease of which we have any knowledge. It has been estimated by historians that during the century preceding vaccination, that fifty millions of people in Europe alone died of smallpox. Contrast this record with the record of an hundred years after its use. This number of deaths in one century about equalled our entire population in the United States in an almost equal period of time from the Declaration of Independence.

Under such existing conditions it has been said that "the human race was beaten down until men became resigned to the disease." "There is no contagion so strong and sure as smallpox;" and, in the language of Watson, "none that operates at so great a distance."

The value of vaccination as a means for the limitation of smallpox, soon after its discovery, was recognized by the governments of Europe, and its introduction among the people was rapidly made by the crowned heads.

Spain at that time held possessions in different parts of the old and new world, and sent expeditions with surgeons and vaccine virus on a long cruise encircling the globe, covering a period of three years.

The possibilities which vaccination offered so greatly influenced the world, that at a very early date compulsory vaccination was established in Bavaria in 1807, Denmark in 1810, Sweden in 1814, Württemberg, Hesse and other German states in 1818, Prussia in 1835, Roumania in 1874, Hungary in 1876, and Servia in 1881.

A brief history of smallpox, and the awful ravages and mortality records which it has left in its prevalence in the early history of the human family, cannot fail to impress the student of history in the widely contrasted conditions which then existed and those which now exist.

Smallpox, no doubt, is as old as the advent of man.

Beginning in the Orient, records establish its prevalence as early as 1122 B. C. India and China and other Asiatic countries long before the birth of Christ suffered from this disease and have left substantial records of its fatality.

The Greeks and Romans experienced its fatal blow, and it is now believed that Athens, B. C. 430-25, trembled under the destroying power of this disease generally termed the plague. The exodus of peoples from one country to another spread the disease until Europe and America received the disease, as man's migration carried it in the progress of adventure, discovery and civilization.

Smallpox is as deadly a foe today to the human family as it was when Rhazes, a physician of Bagdad, wrote his famous work in the early part of the tenth century.

It appeared in Rome A. D. 160, China A. D. 200, Pelusium A. D. 544. It spread over Egypt and Syria and the rest of Asia Minor.

Gregory of Tours, records the appearance of an epidemic in the countries of southern Europe, bordering on the Mediterranean Sea. During the Crusades Europe suffered greatly by reason of the importation of smallpox brought from foreign lands. This disease assumed grave dimensions. Just as travel, commercial and social intercourse increased among the people. The terrible border wars, fought hand to hand in those early days, also perpetuated the disease and annually swept away hundreds of thousands of people in epidemics. Wars then, as now, destroyed an alarmingly large number by disease.

Smallpox entered England in 1241-42, Iceland in 1306, and Sweden and Germany towards the end of the fifteenth century. It was not long finding an introduction into the western hemisphere, as voyages of discovery, headed by intrepid navigators, dared the dangers of unknown seas.

It reached the West Indies in 1507, annihilating entire tribes of savages.

Mexico did not escape. In 1527 it swept away millions of victims there; and, in the language of Prescott in his history of Mexico—

"Smallpox swept over the land like fire over prairies, smiting down prince and peasant, and adding another to the long train of woes that followed the march of the white man. It swept down towards the Pacific, leaving its path strewn with the dead bodies of the natives, who, in the strong language of a contemporary, perished in heaps like cattle stricken with murrain."

So dreadful was smallpox in England that the history of the British kingdom is not complete without some reference to its effect upon the people. Macauley says: "That disease over which science has since achieved a succession of glorious and beneficent victories, was then the most terrible of all ministers of death."

The havoc of the plague had been far more rapid; but the plague had visited our shores only once or twice within living memory; and smallpox was always present, filling our churchyards with corpses, tormenting with constant fears all whom it has not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changling at which the mother shud-

dered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover.

So dreadful was the scourge of smallpox in Europe and so ineffective were all methods of treatment, that the population was so decimated that it was considered a plague from which the king and peasant suffered alike and fell victims to the destroying power of its virulence.

The profession of medicine at this time knew nothing of the real nature of the disease, except its contagion, and were powerless to save even themselves. Before the discovery and introduction even of inoculation, the outlook was gloomy and threatening to the human family. Inoculation of smallpox wrought the first change in staying the disease and contributed to the elucidation of Jenner's discovery of vaccination.

The inoculation of smallpox into one healthy and not exposed to the true nature of the disease, served a purpose only in the time of its discovery or rather introduction into Europe. The great objection to its use was the propagation of the real disease, smallpox, which made it possible for others to contract. Whilst those inoculated were rendered immune from smallpox, great danger existed in its transmission to others. Upon the discovery of vaccination in 1796, inoculation fell into disuse and was abolished by England in 1841 as tending to propagate smallpox.

Epidemics of smallpox, as they now occur, modified in their magnitude and limited in their area, are just as dangerous to the community as in the days before Jenner. For this reason vaccination and revaccination furnish our only method of stamping out the most pestilential disease which knows no clime nor race of men.

Since vaccination does not in every case prevent smallpox, although mild in form, and since deaths do result from smallpox in the vaccinated, sometimes, there have always been and are today, I am sorry to say, people who oppose vaccination for no other or better reason than to differ from the best medical and sanitary thought of the century just ended.

Isolated cases are cited by our anti-vaccinationist friends in proof of their position, rather than a fair consideration given in a large number of cases previously vaccinated.

What does the world owe to vaccination?

What does the world owe to anything? I might ask.

There must be some merit if the world is better for anything done by man. Only a few historical figures stand out in the world's history as having benefited the entire world. There has never been a unanimous verdict in favor of any one great thing which benefited the whole round world. Disbelief and doubt will always obstruct beneficent measures. The progress of the human family is the result of æons in the evolution of thought by means of education.

So that it is not strange that our work as sanitarians is questioned in its final purpose in our efforts to prevent disease. Figures, statistics and results have not entirely brought conviction: even death itself will not produce the *quod erat demonstrandum*.

Strange as it may seem, nevertheless it is true, that the death of the Son of Man on the cross for the whole world, is not yet believed by all men. I speak reverentially. The doubting "Thomases" go up and down this old world flaunting sneer and insult into the fair face of our goddess Hygeia. Enemies of sanitation are not entirely without the ranks of the medical profession. The laity are not the only class wherein we find sanitary obstructionists and the enemies of God and man.

Some doctors ignorant of some things and learned in others, often hold up boards of health and health officers, or try to, when their influence should be with them and not against them, in all questions and matters which have for their common end, the best interests of the community and the health of the people.

The only solution for this phase of sanitary work, in my humble opinion, is education and organization through a long period of time with unceasing effort. Education first, and then legislation, furnish means for final triumph. The arching which we have to fight is ignorance, and until knowledge and conviction are once gained, the work of all of us will meet with strenuous opposition. But we must not falter nor fail. A sacred trust is committed to our care and the consciousness we have in knowing that we have done our duty honestly and well, will atone for all arduous and annoying labor.

It has not been my purpose in the preparation of this paper to burden you with statistics, which are always dry, but I must ask your indulgence in a few quotations to prove to you what the world owes to vaccination:

"M. Bousquet, in his detail of the epidemic which prevailed at Marseilles in 1825, states that the whole population was estimated at 40,000. Of these, 30,000 had been vaccinated, 2,000 had had the smallpox, 8,000 had neither been vaccinated nor had the smallpox. Of the 30,000 vaccinated, 2,000 were seized with smallpox, twenty of whom, or one for every hundred affected, died. Of the 2,000 who before had smallpox, either naturally or by inoculation, twenty were attacked, and of these four died, or one for every four who took the disease. Of the 8,000 who had not been vaccinated nor had smallpox, 4,000 contracted it and 1,000 died, or one in every four. By this it appears that one-half of the non-vaccinated, one fifteenth of the vaccinated, and one-hundredth of the variolated took the disease. But such was the difference in the comparative mortality of the attack in the vaccinated and the variolated, that while the variolated part of the population were cut off in the proportion of one out of every 500, the vaccinated lost only one out of every 1,500; or, in other words, of an equal number of variolated and vaccinated cases, three of the variolated died from the second attack for every one that died who had been previously vaccinated.

"In Berlin, in the year 1872, the mortality of the disease was 243 per 100,000 population, and the year after it was 262. Thereupon vaccination during the first year of life and revaccination at the age of 12 years was made compulsory by law, and with the effect that in the year 1875 the death rate was lowered to 36 per 100,000 inhabitants the next year it was lowered to 31, the next to 3, and so through later years with an average annual mortality of 1.7 per 100,000 people. During the year 1890 only fifty-eight cases occurred in the whole German empire, or 1.18 cases to each 1,000,000 of population.

"A village in Leicestershire, England, of 1,300 inhabitants, was visited by the pestilence in 1872. All but two of the inhabitants were efficiently vaccinated and escaped the disease, whereas the two unvaccinated persons died of it.

"The late Dr. J. H. Rauch, for many years secretary of the State Board of Health of Illinois, has shown that in the Illinois epidemic of 1881-83 the mortality rate of the vaccinated was approximately 6 per cent., and of the unvaccinated it was 49 per cent.

"Corbally has demonstrated that in the Sheffield, England, epidemic of 1887-88 vaccinated children were, as compared with the unvaccinated, twenty times less liable to attack from smallpox, and twenty-four times less liable to die when attacked. That is to say, the vaccinated children had, as compared with the unvaccinated, four hundred and eighty fold security against death from smallpox.

"In the Halifax, England, epidemic of 1892-93 the death rate from smallpox among vaccinated persons was 1.8 per cent., and among the unvaccinated it was nearly 41 per cent. No case occurred in a vaccinated child under five years of age, and in the Leicester epidemic of 1893 no case occurred in a vaccinated child under 10 years of age.

"From the records of 5,000 cases treated in the Municipal Hospital of Philadelphia, according to Dr. W. H. Welch in the New York Medical Journal, March,

1894, it appears that the death rate in that institution in post vaccinal cases, and in all in which there had been an attempt at vaccination were included, was 16.26 per cent., and the death rate in non-vaccinal cases was 58.38 per cent.

"Seventy-three per cent. of the cases in unvaccinated infants under one year of age ended in death, and no fatal case occurred among vaccinated infants of the same age. Between the ages of 1 and 7 years the mortality of post vaccinal cases was 5.7 per cent., and of the non-vaccinal cases it was 51.48 per cent.

"Dr. Benj. Lee, of Philadelphia, Pa., in his report to the Pennsylvania State Medical Society, 1875, shows that the mortality from smallpox in the epidemic then just ceased was 55.9 per cent. in the unvaccinated; in the vaccinated with one vaccinal scar it was 15.2 per cent., while the mortality among those having five or more scars was 5.5 per cent.

"During 1875 the mortality among 1,866 vaccinated persons treated in the Riverside Hospital, New York City, was 375, while among the 405 patients who had never been vaccinated, 200 died." (Eugene Foster, M. D., in American Medical Association Journal.)

I quote from the American Text Book of the Theory and Practice of Medicine, Vol. 1st, pages 288-89:

"In Sweden the mortality from smallpox in the twenty-four years before the introduction of vaccination, was 2,050 per one million annually; after vaccination, 158 per one million.

"Drysdale says of Berlin, that the mortality of that city during the epidemic of 1872-73, rose to 243 and 262 respectively, per one hundred thousand inhabitants.

Thereupon vaccination in the first year of life was made compulsory and re-vaccination in the twelfth year of life, with the result that in the first year of enforcement (1875) the mortality fell to 3.6 per 100,000; 3.1 in the year 1876, to 3. in 1877, and so on for succeeding years down to 1883 with an average of 1.7 per 100,000.

The nearly absolute protection of vaccination is shown again by comparing the cities in which vaccination and revaccination are obligatory and optional. Thus according to recent reports of the Berlin health office, the mortality of smallpox per 100,000 inhabitants in 1888 was in Dresden, 0; in Berlin, .07; in London, .6; in Munich, .75; in Hamburg, 3.58; in Paris, 9; in St. Petersburg, 15.3; in Vienna, 26.15; in Prague, 55.49.

Army statistics are specially valuable from their accuracy. Schultze shows that since the operation of the German law, the annual average cases of smallpox per 100,000 was in the army of Germany, 4.94; of France, 169.72; of Austria, 374.

During the Franco-German war (1870-71) the mortality of small-pox in the unvaccinated French army was 23,469, while that of the vaccinated German army was but 261.

The degree of protection independent of revaccination is determined to a considerable extent by the success of the operation and by the quality of matter introduced. Thus, according to Marson, the average mortality of smallpox among all vaccinated persons is 5.24 per cent., while that of individuals showing perfect cicatrices is .5 per cent.

I also quote from Cyclopædia of Diseases of Children, Vol. 5, Keating, by Dr. William A. Edwards, pages 264-65:

"Blyth concludes from the study of statistics that the mortality of all ages in a vaccinated community will be 5 per cent., while in an unvaccinated community it will be 49 per cent. A striking example of the effects of vaccination on the mortality of smallpox is furnished by the record of deaths from smallpox at Madras India, as shown in a paper by Sir William Moore.

The average mortality from smallpox at Madras from 1871 to 1884, was 1,457. In 1883 vaccination was made compulsory in Madras, and during the years

1885 and 1890, the mortality from smallpox was 35. The gradual stamping out of smallpox in Bavaria by vaccination is well shown by Böhm. Previous to the passage of the vaccination law in 1874, the average mortality from smallpox for 16 years had been 17.5 per 100,000; while since that time it has been .53. But this figure represents simply the average for the 18 years, the per cent. of mortality being much less than this; thus, in 1890, .1; in 1891, .7; in 1892, .05; it has not reached 1 per hundred thousand since 1882."

These are a few figures taken from reliable sources which must have some influence in proving the benefits derived from vaccination.

These statistics are gathered from the writings of well known and eminent physicians, who have nothing to gain from such glorious proofs of the power of vaccination, save the benefits which the medical profession have been able to give to the entire world.

The general distribution of tuberculosis and its fatal effect upon the human family, at this time, is taxing the keenest and brightest intellects, in trying to discover some measures which will limit its spread or produce a cure of the disease.

Tuberculosis was ably discussed in this city (Columbus, Ohio,) last June, at the meeting of the American Medical Association, by our honored president, Joseph Matthews, M.D., LL.D., in his opening address to the Association, and he voiced the sentiment of the medical world, in language too eloquent, and in diction too strong, for me to do other at this time, than wish all here assembled could have heard him.

We have reason to be alarmed at the death rate throughout the world from tuberculosis, and since we have, I wish to call attention to late discoveries made in cases of tuberculosis following smallpox.

It was Laudowzy, in his paper before the congress of tuberculosis, in 1888 who pleaded for compulsory vaccination as an aid to eradicate the tuberculosis predisposition. Lop, in 1899 endorsed his discovery:

"Lop has followed up the study of this subject by investigating 140 cases of smallpox victims who sooner or later became tuberculous. Of this number 64 were personal cases, 54 were studied by Revilliod, of Geneva, and the remainder were collected by Chauvain (These de Paris, 1897), from the clinic of Professor Laudowzy.

To those who would deny in advance the significance of these figures Lop states that his 64 cases were all collected within less than a year. He has besides the verbal declaration of a number of prominent hospital physicians that the apparent casual relationship between the two diseases is not due to co-incidence. With regard to the part played by heredity, Lop found evidence of this nature in but seven of his personal cases. The personal antecedents were equally negative. Thirty-seven of the patients were hard working laboring people, probably poorly nourished and somewhat alcoholic, but there was no evidence of any specific predisposition aside from the fact that they had variola. The other 27 personal cases were people who were well situated socially.

Of Revilliod's patients (54), only 4 showed a history of parental tuberculosis, and 7 had collateral ascendants or near relatives who were tubercular. The personal history was completely negative.

In Chauvain's (22) cases, but two had any family history whatever of tuberculosis. Hence of 140 cases only 20 exhibited any evidences at all of heredity. With regard to the duration of the interval between the time of the occurrence of the two diseases, late infection appears to be the rule. Of Lop's cases (64), 16 developed tuberculosis within four years after the attack of smallpox; 38 developed the disease within the first decade, and 26 within the second decade after the early infection.

Revilloid's observations extend over a period of forty years. Of his material, 18 cases did not become tuberculous until 25 and 40 years after the variolous infection. Chauvain's figures are even more strongly suggestive of late infection.

These figures by themselves would not perhaps signify very much because they are not only small, but they attack the problem from one side only. Laudowzy however, studied the question from another point of view by following up 300 cases of variola; and the astonishing result of his studies was that not more than 3 per cent. of this number escaped tuberculosis in the long run. The weight of evidence then is in favor of late infection of the variolous by tubercle; from 10 to 30 years after, being about the average. When the debut is early, the tuberculosis is usually of the galloping type. The more intense the variola, the more likely is the patient to contract tuberculosis at an early date.

It is thus easy to see how variola is able to assist in the diffusion and maintenance of tuberculosis, and further, that it is even more relentless and malignant than has been imagined; since it slowly exterminates its original survivors in after years by the aid of another great scourge. The lesson of the need of compulsory vaccination needs to be told anew." (*Journal of Tuberculosis*, July 1899.)

The value which vaccination has been, and is to the world, aside from the considerations given, is of immense benefit commercially. Vaccination has made it possible for uninterrupted commercial relations between all nations. Commerce has been fostered and made permanent upon the seas. Foreign countries are kept constantly in touch with each other. Diverse relations with all nations have not suffered by reason of smallpox epidemics.

Unlike many other pestilential diseases, smallpox is in every clime and selects its victims from every color and race of men. It takes in the entire world, and since it does, vaccination is a benefit to the whole world. The whole world has been benefited by vaccination, inasmuch as it has prevented any hindrance or obstruction to emigration or immigration. Vaccination stamps out the importation of smallpox from foreign lands.

When great international difficulties cannot be settled in any other way than by arms and war, vaccination preserves whole armies from smallpox, notwithstanding whatever opposition there may be to vaccination. The civilized nations of the earth to-day vaccinate all soldiers in actual service. As a nation we owe an everlasting debt of gratitude to Jenner and his discovery. It enabled us in less than one hundred years to become the greatest nation upon the face of the earth. It kept out smallpox when there was every chance for its introduction among us in the large numbers of people seeking homes in the new world. It has been practiced so generally among our people of composite blood and nationalities, that we owe the building and structure of our nation uninterruptedly largely to the benefits of vaccination.

Vaccination has been well fostered here, and if not as well as it should have been, our republic will eventually regard it absolutely necessary for all our citizens to be rendered immune against so deadly a disease; or, if not entirely immune, the disease will be amenable to treatment, with a low mortality.

We will carry the glad tidings of life and health to our new possessions in the distant Pacific. The down trodden people of those pest stricken islands, Hawaii and the Philippines, will come in for their share of protection against smallpox. Cuba and Puerto Rico freed from Spanish misrule and modernized barbarism, will enjoy an increased population by reason of the virtue of vaccination.

Mr. President, we should take courage in the work which our Board of Health is doing in Ohio. The position which this board occupies today has been gained after a long, hard struggle. But it is only our tenth annual meeting. Here let us

dedicate ourselves anew to the work which each one of us has to do. Sanitary work is a growth, and its formation in this country is only started.

Before closing this paper permit me to quote the words of the illustrious and now glorified Dr. William Pepper, President of the Pan-American Medical Congress at Washington, 1893:

"The history of European medicine for more than one hundred years is a record of which we may well be proud, when the enormous obstacles to progress are held in view. It is not necessary to remind this audience of a single one of its great triumphs. Vesalius and Parè, Harvey and Sydenham, connect themselves with Bichat and Lænnec, and Hunter and Jenner, and Pasteur and Lister, and Virchow and Koch, and the torch of genius is passed down the line of these immortals and lights up the ages with the splendor of their achievements. But it is sad to reflect upon what has been done as contrasted with what might have been.

"The dense ignorance of rulers and masses on scientific questions, the slow progress of sound, useful education among the people, the huge claims of imperialism and militarism, the wanton waste of luxury, have retarded research, have left but paltry sums available for the diffusion of knowledge, have hindered the embodiment of legislation, and in actuality of much that would help the healing of the nations. It is an odd commentary on the vaunted civilization of today to contrast the sums doled out by the most enlightened governments of Europe for the promotion of education and original research; or for the suppression of preventable diseases with those lavished on the vast hosts of armed men and the huge fleets of unwieldy, armored ships, deemed necessary for the maintenance of peace and order."

In the language of Bowditch, in his address at the Medical Congress in Philadelphia, in 1876, "Our present duty is organization, national, state, municipal and village."

With the bubonic plague threatening us at present by importation, it behooves us to exercise renewed energy in our efforts in preventive medicine.

The unselfish motives of the profession which I represent, cannot fail to meet your approval and endorsement. For purposes, mercenary, the medical profession would not be expected to labor in this great field of prevention of disease; but each member is a warrior, and if needs be, a martyr to the plague's fatality. There will be no recession in our ranks until the secret of man's enemy, disease, is extracted and known.

The day is only dawning; and we see only the first streaks of light from "rosy fingered dawn." The achievements in medicine and sanitary science have been so wonderful that I am not too utopian in predicting still greater discoveries. We have yet to attain unto greater things.

"The unattained! stupendous word!

What visions in its face we see;

And in its syllables are heard,

What whisperings from futurity.

"It points us to a golden day,

Wherein man shall so comprehend

Great Nature's laws—and so obey,

That all disease shall have an end;

"A day when time, exempt from fears,

Shall sit so lightly on the brow,

That man shall round an hundred years,

As gracefully as sixty now.

"Perchance he may on earth remain,
So long as he shall choose to stay,
Then take some through ærial train,
And, like Elijah, whirl away.

" 'Tis coming; yes, we dare to hope,
Though doubt doth every point beset.
The culture tube and microscope,
Will solve the mighty problem yet.

" 'Tis coming—the protecting light
Of higher knowledge yet to be,
As sure as stars come out at night,
Or rivers reach the roaring sea.

" 'Tis coming! expectation thrills
At thought of triumphs pressing on!
See! even now the eastern hills
Are bannered with the flags of dawn."

The President—Gentlemen, I do not know that we will wait for any discussion tonight as it is getting late. We will stand adjourned until 8:30 tomorrow morning.

FOURTH SESSION.

FRIDAY MORNING, January 26, 1900.

The morning session was opened at 8:30 o'clock by the President, who announced that at 9 o'clock the program as printed in the published announcement would be taken up, and until that time the discussion of questions proposed by Boards of Health would be in order.

Dr. H. L. True, McConnelsville—Mr. Chairman, as the papers were passed by without discussion, and as it appears that no others desire to talk, I wish to say a word in compliment of both the papers which were read last night. I think they were splendid, especially the one read by Dr. Rexford. It is seldom that ministers take the interest in matters of health that our brother has done, and I wish to say a word or two in the same line. (Here Dr. True gave an account of a missionary in China who gave converted natives to understand that physical cleanliness was a part of the requirements of the Christian religion, and as those who did observe this law were exempt from many of the diseases to which other natives were subject, it came to be understood that the Christian God took special care of his followers. He also called attention to the fact that Henry Ward Beecher had once said that to teach the people how to avoid dyspepsia and the kindred ills attending it would do more good than preaching Christ, on the ground that a person with dyspepsia is out of sorts, morose and could not enjoy Christianity. He also endorsed what was contained in Dr. Marchand's paper on vaccination.)

(On motion, discussion by one speaker was limited to two minutes.)

Dr. T. J. Dillinger, Murray City—I think last night we had a love feast and many felt it was good to be here. His Excellency, the Governor, gave us a good address, our President's remarks were right to the point and interesting to everybody, and the two papers were most excellent. The minister, in his paper, only left out one thing, and that is the so-called "Christian Healing Science." I think that is one of the most abominable things we have had to deal with since witchcraft. Speaking of the fact that when any scientist comes forward with a new discovery he meets with opposition—wasn't Christ in the same fix? Didn't He have His accusers? Didn't He have a man who betrayed Him, Judas Iscariot? And George Washington had his Arnold, and in more recent times Abraham Lincoln had his Booth, Garfield his Guiteau. So it is no cause to hesitate because there is opposition. We have got to meet opposition, we have got to educate the people up to the standard of quarantine and such things. In our town it takes a stuffed club to educate them. They are intelligent people, but fight the Board of Health when there is a nuisance to be abated. I know if I was a lawyer I would get up a bill which would do away with that difficulty. I would give the people a notice and if they did not do it, I would have it cleaned up and make them pay for it.

F. S. Reefy, Elyria—There is a good deal of education needed in another direction. It is not necessary that we, as the Health Department, go after sick people with a sledge hammer. A word of kindness will accomplish a great deal more than a sledge hammer. I want to impress that matter upon your minds. I have been connected with the Health Board of Elyria since its organization and I have often found that a kind word accomplishes more when people are distressed. You get their good will and accomplish your object. It is not necessary to go to them with the feeling that you must have this done so and so, in an imperious sort of way. You will find that you will get along all right when you reach the people in the right way. To a family in distress, remember that a kind word will accomplish much, removes all resistance, and the result is you will succeed. Try it!

Dr. Daugherty—I have several families of Christian Science in my town and I have trouble in getting them to report contagious diseases. They have refused to have physicians and the Board of Health has been compelled to call physicians and in case the family refuses to pay for the service, the Board is compelled to do it. Does the Board have to pay that service?

Dr. Probst—For treatment of the malady?

Dr. Daugherty—Yes, sir; where there is a contagious disease, or the officer of the board thinks they should have treatment, and the family refuses to call a physician?

Dr. Probst—The Board of Health has a perfect right to find out whether it is a contagious disease, and may employ a physician to visit

the family and examine the case for the purpose of reporting whether it is scarlet fever, or other contagious disease. But there your authority ends. You have no right to send a physician there to treat the child for the disease.

A Member—I would like to know whether these Christian Healers have any law which does not apply to others, and why we have not the same right to send a physician to look after them as for anybody else, and if they are not able to pay, the township would have to pay?

Dr. True—This question of Christian Science treatment is going to be a great hindrance to the work of the Boards of Health. If a man dies without a physician being called, the coroner has a right to go in there and investigate that case and may prefer charges and have the people arrested. But here is a faction in the community which is circulating literature and preaching, trying to educate the people in exactly the opposite direction from the teachings of sanitary science. They claim that every new microbe that is discovered only adds one more dread to the human race of some kind of disease. They claim that all of these preventive measures only just call attention to the fact that these diseases prevail and that no account ought to be taken of these matters and no pains whatever taken to preserve the health. That is their doctrine; it is becoming a serious obstacle to the work of sanitary science, and I do not know what is going to be the outcome.

A Member—We have a family of Christian Science people in our town. Four members died, two of typhoid fever, one of carcinoma and I think one of tuberculosis, without a physician. This summer the father died of carcinoma. Following his death a boy 18 years old came down with typhoid fever—I guess the boy was sick before the father died. The daughter refused to have a physician for the brother, and the father for his son. As soon as the old gentleman died, I sent the physician, who had seen the family two or three times in the last year, to see the boy and ask if he wanted a physician or guardian, and who he wanted for a guardian. He reported to me that the boy wanted medical attendance and a guardian. I took the man he selected and went to the probate judge and he was appointed guardian. He took charge of the case, employed a physician and nurse and the boy got well.

A Member—I have a question I would like answered. Would a Health Officer have the right to accept a death certificate made by a midwife not registered?

(Dr. Probst called for.)

Dr. Probst—I don't believe I can answer that question now.

The President—The Secretary is not prepared to answer the question now; can any one else offer an answer?

Dr. Stanton—If the certificate of the midwife is to be accepted under any circumstances, it should be under the circumstances mentioned. Of course, she is practicing without legal authority, but it would not affect

the certificate she would furnish. She would be liable to prosecution for practicing without registration, but I do not see how it would affect the validity of any certificate she would give. I think the certificate of a midwife might be accepted where a physician has not seen the case. I think that is a rule of the Board of Health. Dr. Probst thinks there is no such provision, but I thought there was.

A Member—Is there any quicker legal way of abating a nuisance than the one in vogue at the present time?

The President—That is a legal question. That is a very general question and will not admit of a brief answer.

The time has arrived for the reading of papers. The first is by Dr. W. T. Gemmill, Member of the State Board of Health, "The Diagnosis of Smallpox."

THE DIAGNOSIS OF SMALLPOX.

By Dr. W. T. Gemmill, Member State Board of Health, Forest.

The repeated outbreaks of smallpox in this and adjoining states during the past two or three years has no doubt emphasized the necessity of studying the symptoms of this disease more closely, and especially differentially, that the mistakes made by physicians may be guarded against, hence the subject assigned—The Diagnosis of Smallpox.

All so-called "authorities" in books that I might quote on this subject are equally accessible to students and other practicing physicians with myself, so that the symptoms of this disease as therein stated need not be rehearsed in detail at this time. It is the variations from the genuine, well marked cases that are misleading. Vaccination has so modified this disease that mild cases are frequently misnamed until too late to prevent the dissemination of the most highly contagious disease we have to contend with.

One case of smallpox, however mild, is *prima facie* evidence of others, and any one having come in contact even remotely should be strictly quarantined.

However, the rules of quarantine are so unpopular with the public (and even with the profession) that from my own experience I do not place very much confidence in the history of a case, unless it corresponds with the symptoms I find.

The period of incubation varies according to the mode of inoculation. If this has been by direct contact with a patient suffering from variola, the time elapsing until the prodromal symptoms will be about a week. If inoculation has been indirect, by infection from clothing, etc., or through the atmosphere, as in cases of epidemic, the disease will not appear for from ten to fourteen days.

Usually the disease, mild or otherwise, is ushered in suddenly by severe headache, muscular aching and pain in back, in fact, the aching and pain all over is excruciating and almost unbearable. High fever, extreme nervousness, sometimes nausea and irritable cough. A rash may appear on the second day. Is more apt to be present in a mild case than in true variola.

The initial symptoms increase in severity up to about the fourth day, when an eruption makes its appearance, first on the forehead or scalp, passing downward to the wrists and trunk. With the appearance of the eruption the temperature rapidly falls, and the muscular pains also subside to some degree, but as it develops, itching and burning begin and the patient has no rest.

The eruption of variola seems deep, and as it assumes a papular form gives to the touch that peculiar shot like feeling under the skin, while the surface of the skin itself is smooth.

As the eruption in variola observes a regular progression, *downward* over the body and *through* the different stages of development, the papules soon form or develop a little vesicle which as it matures becomes umbilicated, the eruption then assumes the third stage, known as pustules, which if punctured will discharge a fluid, but instead of collapsing becomes rounded and full in appearance. The fourth stage, or scab appears in due time.

The secondary fever, characteristic of smallpox, is dependent upon the third stage of the eruption, viz.: pustulation, and if the case be mild enough not to reach this stage the second attack of fever will be absent.

As stated in the beginning, the symptoms of a typical case of variola are easily interpreted, but it is the mild cases, that are complicating, by reason of the resemblance to other eruptive diseases, hence the mistakes made by physicians.

Varicella is perhaps the most common misnomer, and I will notice the difference between these two diseases:

If the patient be a child, an epidemic of the diseases incident to childhood will of course always be considered, as also the fact that adults may contract such diseases.

As a rule, the eruption of chickenpox is not preceded by the prodromal symptoms of smallpox, certainly not in severity, even though there should be a general feeling of malaise for a day. The eruption appears first upon the neck and body, or may appear simultaneously, and the febrile symptoms rise with the eruption, while in variola the fever subsides as the eruption appears.

The eruption of chickenpox runs a much shorter course than that of smallpox, and may develop two or three crops, thus showing the eruption in different stages all in close proximity, contrary to the symptoms of variola.

The eruption of chickenpox seldom reaches the stage of pustulation, except in the case of a few scattering ones, but the vesicles being filled with a watery fluid reach maturity in about twenty-four hours, and begin to dry up, first at the top of the little cone, and this accounts for the umbilicated appearance, simulating a characteristic symptom of variola.

However, the umbilication of the pustules in variola is due to a different cause, viz.: that usually in the center of a pustule in variola you will find a hair follicle, and the eruption being deeper, there is a depression until the pustule fully matures or is punctured, when as stated before the pustule will assume a rounded appearance.

To interpret the difference between the symptoms of varicella and varioloid is not so easy. While some few people are immune by reason of some peculiarity of their system that renders them proof against the poison without the help of vaccination, yet the majority of the human race are not so favored, and the practice of vaccination more or less general among civilized nations has so modified the disease that varioloid is the most common form.

The period of incubation of variola and varioloid do not differ, and the prodromal symptoms of the latter may be as severe as though it were a case of variola.

Varioloid is equally as contagious as variola.

My experience has been that varicella always runs its course, without interruption either with or without treatment. Varioloid is characterized by an interruption at one or other of the first three stages, according to the severity of the case. There may be a few scattering pustules, but not a sufficient number to give rise to the second attack of fever, hence the controversy so often on this point that the disease is not smallpox or varioloid.

The eruption of varicella reaches complete development in *three days*, while the eruption in any form of smallpox requires nine days to *pass through the four stages*, or reach the fourth stage, or scab.

The prodromal symptoms of varicella are so slight compared with varioloid that they can hardly be confused, and the fact that in the former the fever *rises*

with the eruption is also a characteristic symptom of this disease, and not to be found in varioloid.

The fact that the eruption in varioloid may appear on the trunk first or as in varicella on different parts of the body at the same time is confusing. However, there is sufficient difference in the character of the eruption itself to make a diagnosis possible after it has reached a certain stage. The eruption of varicella is more superficial and the skin has a rough pimply feeling, while in varioloid the skin is smooth. The rash of varicella will disappear upon pressure and return after removing your finger, while the rash or first appearance of the eruption of varioloid assumes a deeper hue upon pressure and rather purplish.

While I have been called to decide between varioloid and a disease known as impetigo contagiosa, I do not think there is sufficient similarity to warrant me in entering into the details of this disease at this time.

(There may be slight prodromal symptoms such as fever and aching, but the eruption is so different, appearing first as vesicles which soon reach maturity and are usually found on the face, neck and limbs, seldom on the body, makes the diagnosis easy.)

Experience is worth more than anything else in the interpretation of the symptoms of a modified case of variola.

A hard and fast rule cannot be laid down to apply to every case in every particular, but a careful observer will notice differences early enough to put him on his guard, and as stated by the ablest writers on this subject, a positive diagnosis cannot be made in some cases until the eruption has sufficiently developed to justify same, quarantine *can* be employed from the first, and thus save much trouble to all concerned.

As physicians we should consider this matter seriously, and seek to educate the people along this line for their own good and bring the rules of quarantine into better repute.

The principle underlying the proverb that an "ounce of prevention is worth a pound of cure," is well applied in questionable cases.

As it is in the initial stages of diseases that diagnosis is so difficult, so it is in the initial stages that quarantine must be employed to be effective, and while I am aware that in touching on quarantine I am not keeping strictly to my subject, yet I believe the present state of affairs warrants me in urging this matter at this time.

Dr. W. L. Buechner—I have listened with a great deal of attention to this paper and am very much interested in the subject, and there are some points on which I cannot agree with the Doctor. He says the period of incubation may last up to 14 days. That is too short a time. I have repeatedly seen cases where the incubation time was extended to 20 days, and under no circumstances where I have anything to say, would I remove quarantine under 21 days. It will not be safe, gentlemen. I can assure you that from my practical experience in a large number of cases.

Another thing, the Doctor did not mention one thing upon which I place more importance in the diagnosis of smallpox than any other, and that is the shot-like hardness of the eruption when it first appears. I have for 45 years diagnosed cases of smallpox. In Youngstown we have had five or six outbreaks and I have been fortunate enough not to make a mistake. I admit it is hard to do and some of our best men have made mistakes, but I never found a case where I found that hardness in eruption which was not smallpox. I rely upon that more than anything

else. Of course, if your patient will complain of chilliness, pain in back—thinks it is breaking—and there is smallpox near, you can suspect it: but I have repeatedly, where there was no suspicion of smallpox, diagnosed the smallpox from the pains and the shot-like hardness of the eruption.

(Upon motion the two-minute rule is suspended and Dr. Buechner allowed to proceed.)

Dr. Buechner—The only thing I wanted to mention was the difference between the smallpox and the chickenpox. Now, I have always found in chickenpox that I would find all the different stages of eruption on the body at the same time. In some places there will be the pustule form and in some places it will be dried up already. I never saw that in smallpox. It always kept the different stages all over the body at the same time. And in my experience I always find the first eruption on the forehead, at the edge of the hair, and on the wrist, before I find it any other place.

Dr. Probst—There are so many here who are not physicians that I want to say a word or two to direct the discussion into a different channel. It sometimes happens, when physicians get to quarreling among themselves as to whether there is or is not smallpox, that the question arises as to what is the duty of the Board of Health. The law makes the Board of Health responsible, and they ought to take the initiative if they have any reason to suspect that there is smallpox present. The Board has a right to appoint physicians to investigate, and if there are none in the community of sufficient experience in this disease, it may call upon physicians from other points in the State, or may call upon the State Board of Health, and not wait until the matter is settled by the local physicians. In the diagnosis of the present epidemic there have been many instances where a diagnosis could have been as well made by a layman as by a physician. I have been called into communities where the disease has been in progress for several months. If anyone had gone to families having had it, and made a list, taking those who had been vaccinated and those who had had chickenpox, the ages of the patients, and those who had had smallpox, they would have diagnosed the disease as smallpox from the evidence. They would have found that vaccination had given almost perfect protection; that children who had already had chickenpox had this disease, and that many cases were adults. Where you find this there is smallpox, you may be sure.

Dr. Stanton—Great stress has been laid on umbilication. It is an exception to the rule in chickenpox. In smallpox you see it almost always. In chickenpox, umbilication occurs, if at all, early in the disease as compared with the time in smallpox. Umbilication in chickenpox occurs by absorption of the serum in the vesicle on the second or third day. In smallpox it is caused by the accumulation of pus around the hair follicle in the center of the pustule which forms a depression that

lasts until it is matured or punctured, but this umbilication does not take place until five or six days. The point made by Dr. Buechner is important, as to the feeling of the skin and I think that is perhaps the most important guide aside from the clinical history.

Dr. Howland, Plain City—I have had considerable experience with smallpox and know something about what will happen if you rely upon laymen for report of sickness in the family. We have had cases of smallpox so mild in a family that they have not been reported to the next neighbor, and that patient has infected others of the family.

Dr. True—Before this discussion ends, I would like to ask some of the older physicians, those who have seen a great many cases of smallpox, like my friend here (designating Dr. Buechner) who has been making diagnoses for 45 years, whether it is their opinion that smallpox is really running out? From the description of the disease as given in these later reports, it is nothing like it used to be.

Dr. Laudick, Lima—I think all are agreed as to the different points of diagnosis brought out in this discussion. Of course, all are liable to make mistakes, but there are certain points in smallpox which, if a physician sees one case, he will not forget, especially the shot-like condition of the skin, spoken of. But he cannot make that diagnosis from the center of the road, looking through a window. I heard of a man examining cases from the middle of the road, shutting them up for a little while and then letting them out. If the physician is afraid of the case, he had better call in the undertaker or somebody else.

Dr. Gemmill—In reply to Dr. Buechner of Youngstown,—in my paper I spoke of this shot-like feeling of the skin as one of the characteristic symptoms of the disease, and I rely upon that in cases where the diagnosis is rather difficult. The period of incubation I give as 14 days. I remember one case which did not contract the disease until 21 days. My experience as to the time is 10 to 14 days, tho' there are exceptions to this rule. In regard to umbilication, the pustules in smallpox usually form around a hard follicle which gives this appearance; in chickenpox you see it sometimes by the drying up of the fluid within the vesicle.

The President—We will close this discussion and listen to the next paper, "How to Increase the Efficiency of Township Boards of Health," by J. A. Harned, Clerk of the Board of Health, of Xenia Township, Greene County.

HOW TO INCREASE THE EFFICIENCY OF TOWNSHIP BOARDS OF HEALTH.

By J. A. Harned, Clerk Township Board of Health, Xenia Township, Greene Co.

MR. PRESIDENT AND GENTLEMEN OF THE CONVENTION: Having been requested to open this discussion as to "How to Increase the Efficiency of Township Boards of Health," a brief resumé of these boards and their territory is in order.

In 1893, by legislative enactment, boards of health were organized in a majority of the townships of Ohio. They are composed of the trustees and clerks, and

subject to frequent changes. Their duties are multifarious, and when to these was added the care of the health in the township, they lacked interest and information.

After a lapse of six years and owing to a revision of the "poor laws," they have been more frequently called on and have grown in experience and efficiency until they are an indispensable adjunct to the city or village.

In many townships the clerk is called to act as health officer. He is neither a Solon or an M. D., but *sui generis*. Finding himself vested with almost autocratic power, he believes himself omnipotent. He is not omniscient, but has need to be omnipresent. He is a "bigger man than Old Grant." He reminds one of the old colored man who was walking slowly along the street with a small box under his arm, when he was accosted by a sable youth, "Say, Uncle Eph., what you got in dat box?" "G'way, chile, and don't sturve me, I'se a funeral."

The territory of the board is that lying outside of the city or village. It contains the slaughter houses, dairies and dumping grounds of the same. All garbage, rubbish and filth are dumped within its limits. Dead animals are hauled out and left on its highways, until "their offence is rank and smells to heaven," when they are taken in charge by the road supervisor, who promptly files his bill with the trustees. Every man considers it his special vocation to pollute its streams, and whether it be slaughter house or State institution, dye houses or distillery, pig pen, paper mill, or cess pool, it is so constructed that its drainage and pollution finds its way into the streams. The farm houses with regard to sanitary surroundings may be classed as medium, bad and execrable. The tenant houses are exclusively bad. The pig pen, manure heaps and cess pool are placed, to tempt Providence, in proximity to the well, which is so situated as to receive in addition the kitchen slops. It is to these houses the health officer is most frequently called to combat disease and the inhabitants. Here, too, he meets the physician in the case, who derides his theory that copperas is a good disinfectant because it kills the smell. He also finds frequently he is not "in it a little bit" with his friend the M. D.

Passing to a discussion of the question, my first suggestion would be—

A plain set of rules defining the powers and duties of these boards and their officers. Plain rules for laymen. The State Board has formulated a set of rules which, while they are good, are not always applicable or explicit in townships. These rules should define the length and force of the quarantine in all cases of contagious diseases; also, the best methods of disinfection outside the formaldehyd apparatus. The average township does not care to go to this expense, as it may not be used once in a year. Besides this objection, formaldehyd is worse than useless in the hands of an inexperienced or careless man.

Second: The health officer should, in all cases, be a physician. By reason of the revision of the "poor laws," as interpreted by some of the infirmary directors, the trustees must employ a physician for "outside poor," or go without one. It is cheaper to employ. Then why not make the physician health officer? All disinfection and fumigation could then be done under his supervision.

This is a necessity. Facts coming within my personal knowledge would demonstrate it. Six houses disinfected for diphtheria and scarlet fever within four hours with one formaldehyd generator. Item, a funeral held where a child had died of scarlet fever. Item, a man quarantined for smallpox, and the health officer refused to furnish supplies, and so on *ad infinitum*.

Third: County associations. The Book puts it that "in a multitude of counsellors there is wisdom." While this might not be wholly applicable to township boards of health, yet much good would accrue therefrom. Experiences could be compared, methods and measures discussed, territory gone over in common, and occasionally an address injected from some well informed source.

Fourth: A more stringent law with regard to the collection of vital statistics and certifications of contagious diseases. Taking the lack of such record in my own township as a criterion, I would infer that neither a birth or death has occurred in the past six years, which would indicate a lamentable lack of virility and a depressing state of health. The clerk may learn of a death in the township from the papers, or an undertaker may wish to remove the body and come for a permit. He may learn of a contagious disease 48 hours after its discovery, or a neighbor of the patient may come to the office and tell him. My medical friends will not consider this a criticism. They are busy men, and have more important things to occupy their time than collating vital statistics and certifying contagious diseases to the clerk, especially as they are not paid for their service.

Fifth: A tax for sanitary purposes. As the matter now stands all bills incurred for food, medicines, fuel, etc., are chargeable either to the general township or poor funds. These funds are usually small, owing to the duplicate on which they are levied. The smaller townships are, therefore, hampered in carrying out the provisions of the law. Cases of contagious diseases are not received or paid for by the infirmary directors and fall to the trustees, who are slow to incur expense when funds are not in sight. As stated, a majority of cases coming to the notice of the board of health are from the tenant houses. On examination the health officer finds generally that they are destitute. Everything must be furnished, and in the end it costs. Permit me to cite a single case: Two months ago my attention was called to a family of seven persons, all down with typhoid fever. They were found in a six-room house, three of which were habitable. One room was used for a kitchen, the two others for bed chambers. A man was furnished to attend to outdoor work, and a nurse. Medicines, clothing and provisions were furnished. The wife and one child died; a young man, before recovery, developed gangrene, was removed to the infirmary and suffered an amputation above the knee. The case cost the township \$168.50. A few cases like this would bankrupt the average township. As stated last year in a short paper read before the convention, a tax varying from one-eighth to one-fourth of a mill would be adequate in a majority of townships, except in case of an epidemic.

The proposed amendments sent out by the State Board in the October and November Bulletin should be further amended by one authorizing townships, where boards of health are organized, to levy a tax for sanitary purposes.

Gentlemen of the State Board, you have provided a beautiful collection of fireworks, but have omitted the punk.

In conclusion: In the six years of their existence these boards have accomplished much. They have abated nuisances, have mitigated or wiped out abuses, ameliorated the condition of many in times of distress, combatted ignorance and prejudice, and today are a power for righteousness which is akin to right living.

"Honor to whom honor is due."

The President—There will be no discussion of this paper just at present for the reason that the paper just read and the following ones are branches of the same subject, and the discussion will follow when all have been read. The next is "Laws Regulating Boards of Health," by Dr. F. E. Kitzmiller, Health Officer of Piqua.

LAWS REGULATING BOARDS OF HEALTH.

By F. E. Kitzmiller, M. D., Health Officer, Piqua.

In presenting to you my thoughts upon this subject, I am almost at a loss where to begin and where to end. Every man, woman and child in the state of Ohio, rich or poor, white or black, is entitled to the protecting and life saving services of our state and local health authorities.

I know of nothing that will so quickly and completely injure and kill the business of a town or city as the spread of a malignant contagious disease.

I know of towns in Ohio, whose business men have lost thousands of dollars and been almost ruined by the presence of contagious disease within the past two years.

It is certain we need good, safe health laws, but, more important still is the selection of good men to enforce them. A good health official who strictly carries out the law will save lives, but will make some enemies. As soon as an official of this kind gets among the ignorant and uneducated, he is sure to encounter opposition. People who from any cause oppose proper quarantine and restrictions must be dealt with according to law. A course of this kind may make enemies, but it will protect the people and stop the spread of contagious disease.

The city I represent was for many years a hot bed of diphtheria. We have had there as high as twenty-five deaths in one season, viz.: fall until spring, yet during the year of 1899 we did not have a single death from this disease. To close quarantine, strict enforcement of the law, antitoxin and formaldehyde gas the credit is due.

Our local board of health feel very proud of this record and also feel thankful to Dr. C. O. Probst, the worthy Secretary of the State Board of Health, for his advice and support, it being at his suggestion that we put on extra sanitary police and effected a quarantine as close as we would in smallpox. There is no question but we have stamped it out and have been the means of saving many lives and much suffering. I refer to our experience only to show what can be done, or better still, what has been done, and all this under our present laws.

I had the honor last year of reading a paper before this body upon the subject of "Should Boards of Health Provide Antitoxin?" In the consideration of this question several matters were discussed, and I remember quite well that I expressed myself strongly in favor of the state law which constitutes every board of township trustees, a township board of health. I think as much of that law now as I did then. It is certainly a good, wise law, and should be carried out in every township in the state.

In many townships I am satisfied that the trustees have been careless. Many townships not appointing a health officer at all, and others appointing some mechanic or farmer who is utterly incompetent to discharge the duties of the office.

This should be changed, and in view of the fact that most townships in the state employ a physician by the year, this physician should be made the health officer, which could be done for a small increase of salary.

The laws provide that towns, with a population of five hundred and over, shall have a board of health consisting of six members, to be elected by the council. These councilmen are elected by the people, and the board of health they elect, shall elect a health officer, etc. In our city and many others the local laws of this board of health demand that the health officer elected shall be a physician in good standing, and in compliance with the state law, he shall or may be elected for a term of two years — yet only to serve at the pleasure of the board. This official, as you see, can be removed at any time for cause.

All this seems to me very good law for the people, and leaves the selection of officers where it justly belongs, in the hands of the people.

I am satisfied that a board of health consisting of representative citizens is a good thing in every town and city, and that it gives the health officer proper standing and support in the discharge of his duties.

Experience and investigation has proven to me that the present laws are all very good, and while they might be amended and improved in some respects, yet if they are strictly enforced by health officials, I am certain that the people of the state will receive ample protection and experience few epidemics of contagious diseases.

We are not so much in need of new laws as we are in need of the present laws being enforced.

Having personally investigated the carelessness of health boards in a few instances, where our own city was in danger, I have found that there is a want of attention and very great carelessness upon the part of health officials. In one town, houses where scarlet fever existed were not even placarded until complaint was made, and children still scaling off dead skin, were allowed to run the streets.

In view of this state of affairs, which I believe has existed in many parts of the state, something should be done to cause the laws to be enforced, and I believe that every county in the state should have a county health officer, who should have charge of the whole county. He should be an experienced physician and able to diagnose all contagious disease, and should be paid sufficient salary to insure good and faithful services. Every health officer in the towns and townships of the county should be required to report to him every case of contagious disease, as well as reporting to the Secretary of the State Board of Health.

The county health officer reporting at once to the State Board all contagious diseases, also any carelessness he may discover in the county. This would certainly cause every town and township board to see to it, that proper precautions are taken. I know of no county official that would do more for the people than an active and intelligent county health officer.

I take it for granted that these meetings of the state and local boards of health are held for the purpose of exchanging ideas in the interest of the public health, and that every one is at liberty to express himself upon any subject, and I am here to frankly say that I am not in favor of the "bill" that is to be presented to the Ohio legislature, which creates a commission of three men to be appointed by the governor, who are to directly or indirectly appoint health officers in all the towns and cities of the state of over three thousand population. This commission is to take the place of all health boards in these cities and grind out health officers with neatness and despatch. What a beautiful compliment this is to the business men all over the state, who are serving as members of boards of health without compensation and with only their city's welfare at heart!

Under these new laws in all villages and towns of under three thousand population, the mayor has authority to appoint the health officer. In the townships the trustees are boards of health and may appoint the officer.

Why is it that these small towns and townships are not taken in under this new law and health officers ground out for them, too, while the machine is working. Are these small towns and townships better prepared to diagnose and quarantine contagious diseases than the cities? Have they demonstrated that they are able to take care of themselves to such an extent that they are safe to govern themselves? I think not.

The larger cities pay their health officials better salaries, and beyond doubt get better services. "Consistency, thou art a jewel," but just where it is to be found in these new laws, I am not able to state. What a beautiful political machine this would be! You may write beautiful poetry about a merit system, but

when it comes to a show-down, the best hand will take the *jack-pot*, and right there is where the man with the "political pull" will show up the best hand and win out.

I do not know of one reason why a commission of three strangers can select a better health officer than the citizens of a town or city can select for themselves, but I do know of a thousand reasons why they can't.

I do not believe there is in the state of Ohio a town or city of over three thousand inhabitants, be it Republican or Democratic, where there is not enough intelligence and good judgment to select good men for office, and upon inquiry I find that the people desire to rule themselves.

It might be thought that in as much as we have a Republican governor and Republican legislature, that I being opposed to this "bill" must be a Democrat. I am free to say that I am not; I am a Republican, but I am opposed to this kind of legislation, and I trust that the present legislature will pass no laws that will take away the rights the people have to govern themselves.

In conclusion, gentlemen, we are here in the interest of the people. We represent nearly every county in the state; we all have some influence with our legislators, and it is our duty as good citizens to make a personal effort for good, wise laws.

If you think this "bill" creating a commission to manufacture health officers ought to be a law, work for its passage. If, on the other hand, you believe as I do, that the contemplated law is not for the best, and that the people of Ohio are intelligent and capable enough to govern themselves, I ask that you use your influence to defeat this effort to fasten upon the people a law that all political parties ought to be ashamed of.

The following paper was then read by Dr. Probst, entitled,

CHANGES IN HEALTH LAWS PROPOSED BY THE MUNICIPAL CODE BILL.

C. O. Probst, M.D., Secretary Ohio State Board of Health.

The readers of the "Ohio Sanitary Bulletin" could have noted in the October-November number of 1899 an extract from the bill proposed by the Municipal Code commission which relates to boards of health. These proposed changes in our health laws should have serious consideration. I propose to very briefly present for discussion some of the salient features, and, in that connection, consider the question of creating county officers of health.

The Municipal Code Bill divides municipalities into cities and villages, all those of more than 3,000 inhabitants being classed as cities. In all cities and villages the board of health is replaced by a health officer. In villages the health officer is appointed by the mayor; in cities, by the Director of Public Safety. In cities which, remember are all municipalities of over 3,000 inhabitants, the health officer must undergo an examination by the State Commission, provided for in the bill, or by an examining board appointed by said commission. Appointments will be in the order of merit, as determined by examination. The health officer when so appointed, can only be removed from office for cause, to be set forth in writing and filed with the State Commission. In cities the sanitary police, clerk and other employes of the health office are to be selected in the same manner, and removed for cause only.

A pension fund may be created for the sanitary police, and an annual sum, not to exceed \$500, paid to those who have had twenty-five years of service. The health officer is not included in these benefits, as perhaps, he ought to be.

All the power now conferred upon boards of health are transferred to the health officer.

No change is made in the law establishing township boards of health.

These are the most radical changes. Some of the health laws have been strengthened. Section 2122 is enlarged so as to permit *any* city to select scavengers and arrange for the removal of garbage and offal. A special tax, not exceeding two-fifths of a mill for one year upon each dollar of taxable property, may be levied by any city for a garbage furnace.

Quoting from Section 2095 of the Municipal Code Bill, "Every city and village shall be required to pay all damages caused by the use, occupation or destruction of all property by the health officer, the health department, or by order of the State Board of Health, for the purpose of preventing the spread of all infectious or contagious disease or the treatment thereof."

No change has been made in the provision for paying the expenses of the board of health or, as it would be under the Code Bill, of the health officer.

The law requiring that plans for water works and sewerage systems shall be approved by the State Board of Health has been improved and strengthened.

These, in brief, are the chief features of proposed changes in our health laws.

There are some reasons to urge against doing away with boards of health. In some of our smaller cities and villages (our large cities have no boards of health) these are composed of men who have become deeply interested in the subject of sanitation, and who form an advisory board constantly supporting and assisting their health officer. It must be admitted, however, that this is not true in the majority of cases. The position of member of a board of health is usually regarded as a most undesirable one, especially in the smaller towns. It consumes time, it brings one constantly in conflict with his fellow townsmen, often injures his business, and for all of which sacrifices he seldom receives even the thanks of the people he serves. As a consequence it has been impossible to establish or maintain a board of health in some places because six men could not be found who were willing to serve in that capacity. Where such boards are nominally in existence, it is often difficult to secure the presence of a quorum for a meeting; and practically everything, and especially the disagreeable features of the work, is left to the health officer. I have already said that there are many exceptions to this rule.

The bill might be changed, if thought desirable, so that a city could elect to have a board of health; but there should be no change in the plan for selecting the health officer and other employees.

The Municipal Code Bill has proposed a plan for the selection of properly qualified officials. This is to select the fittest by an examination. The success or failure of this plan would depend upon the examiners and the manner of conducting the examinations. There may be doubt of it always finding the best man; but can a better plan be suggested? It at least makes preference for political reasons impossible.

There is another factor entering into the selection of competent health officers not directly provided for in this bill: that is their compensation. It can scarcely be expected that men are going to spend time and money in specially fitting themselves for the position of health officer, or, that being appointed, they will devote much of their time to the office without something approaching an adequate compensation. If people want protection in the matter of health they should pay for it, just as they now pay firemen and policemen for protecting their property.

There is a special reason why the compensation of the health officer should not be entirely left to the community he serves. The reason is that the more efficient his work the less will he have to show for it that the general public will understand. As he is engaged in the *prevention* of disease, there is apparently the

least need of his services, when he is in fact doing the best work. I have known councils to propose abolishing the office of health officer because, in some years time they had had only a few cases of contagious disease in the community. The health officer got little or no credit for his prompt and intelligent action which had prevented these diseases from spreading.

A case of smallpox is introduced into a city; the health officer promptly takes charge of the patient and all exposed persons, and at once arrests the disease. He seldom gets any credit for this. In another city the health officer is inexperienced or neglectful, and an epidemic of smallpox results because of this. He now becomes very *busy*, and council most willingly votes him an additional compensation for extra services.

The Municipal Code Bill makes no provision for any fixed salary for the health officer, but leaves this to the council of each community. Would it not be possible, and fair to all concerned, for the legislature to fix a minimum salary for the health officer at so much per capita for the population he is to serve, allowing council to increase but not decrease this amount?

Some changes should be made in the law providing means for paying the expenses of the board of health, or health officer. Those who have had practical experience on boards of health know the difficulties encountered in getting councils to pass the necessary appropriation ordinances to pay such expenses. Under the present law council may levy a tax for sanitary and street cleaning purposes. It often happens that the streets get the major part of this, to the detriment of the board of health. This fund should be separated. The numerous instances that have come to my knowledge of councils refusing to make any provision whatever for the expenses of the board of health leads me to believe that the legislature should require each city, village and township to levy a minimum sum for sanitary purposes, which, perhaps, could best be fixed according to population. Council should be authorized to raise a larger sum in their discretion.

Township boards of health, in some way, should be brought into harmony with this plan for the selection of health officers by the merit system, if that is possible. As we have a paper on our program on "How to Increase the Efficiency of Township Boards of Health," I shall not discuss this side of the question.

A most desirable change in our health laws, in my judgment, and especially so if the Municipal Code Bill is to become a law, is for the legislature to enact laws corresponding to the standing orders and regulations of boards of health. While it is necessary that there should be some *elasticity* to health regulations in order that they may be properly adjusted to the varying conditions of different communities, there are certain regulations which should be uniform for the entire state. The essential features of measures necessary for the control of contagious diseases should everywhere be enforced. Many of the regulations for the control of nuisances might also be uniform for the state. I would suggest, then, that the essential features of the rules and regulations to be enforced by health officers or boards of health may be state laws. If health officers are appointed in conformity to the Municipal Code Bill, it should be their sworn duty to enforce these laws, subject to removal from office for failure or refusal to do so.

For a complete and harmonious organization of the health service for the entire state, there would seem to be required a County Health Officer. We are proposing a competent health officer in each township, city and village; we have a State Board of Health; to round out the whole we should have a health officer in each county with a general supervision of health matters throughout his county. He should have an office in the court house, and should collect and keep complete returns of all births, marriages, deaths and dangerous contagious diseases occurring in the county. He should have advisory relations with the municipal and township health officers, with superior powers in certain emergencies; and should

be required to make such investigations of, and furnish such reports relating to, sanitary conditions within his county as the State Board of Health should from time to time demand.

The pros and cons of this plan will, I hope, be brought out in discussion. It is in brief—

1. The appointment on the merit system, of a paid health official in each township, village and city. to be kept in office during the satisfactory discharge of his duties.

2. The enactment of essential health regulations into state laws.

3. The creation of county officers of health to have supervision of the proper enforcement of such laws, and to collect and preserve vital statistics.

4. The requirement, by act of legislature, that each city, village and township should annually provide a certain minimum sum for the expenses of the board of health.

Dr. Marchand—I am glad to have heard an expose of the proposed bill from the Secretary of the State Board of Health, and I think I voice the sentiment of all gentlemen here assembled. Regarding the merit system, under which all health officers of cities would be appointed, I think all gentlemen here will agree with me, as far as the medical profession in cities is concerned, that the large number of reputable, intelligent, active business men in the profession who earn their livings outside of such an appointment would not be the men to go into an examination of that kind. Reputable men in the profession are not going around begging for an appointment for such a position, and when it is a question whether it is any personal benefit to him to be a health officer. It makes him all kinds of trouble while he is exercising his duties, and entails the everlasting hatred on the part of the ignorant populace after he goes out.

In what branches is the examination to be? Those who might pass the best examinations may be the most undesirable men in the community, have no directive capacity, have no intelligence to act for the board in matters of grave importance, and matters requiring the most decisive action at the time will fail utterly in the hands of an inefficient man. I know walking encyclopedias who can put down the best thought of the best medical men in the profession on a competitive examination who would be worth nothing as executive officers.

H. J. Clark, Oberlin—I simply wanted to say that in our place we have had no trouble in securing a board of health. They are all of them business men, among our best men, and are ready at all times to give the necessary time to come together to consider cases that come before us. Our health officer, by the way, is the marshal of the town, and his pay is provided for in the same way as for the marshal. He is really the executive officer of the board of health. All important matters come before the board of health, and are decided by this board, and the health officer is sent to execute what the board decides upon. It has worked well with us and there has been no difficulty in the enforcement of the laws. The only difficulty at any time that we seemed to have was the one spoken of

by the Secretary, that there was no money at our disposal. However, our council has been very ready to pay the bills which have come from the Board of Health.

(On motion the two-minute rule was rescinded in favor of Dr. Marchand, and that gentleman allowed to continue his remarks.)

Dr. Marchand—I think there is a time for every man to talk and a time for every man to keep silent, and possibly I have said all I should say, but I would like to elaborate a little. One of the great arguments brought against an officer in the community, in case of a gentleman who has acted as health officer for some time and has experience, is he has had the office long enough. When his experience is beginning to be worth something to the community in which he lives, and he is capable, we ought to hold up the hands of that man and keep him in office to serve the community. Sanitation is growing, and it takes a long time to convince the people of the efficiency of the board of health and the work it does. If we prevent disease by quarantine, it takes time to know how to do that, it takes experience to know that.

What is the merit system? What will it provide for? What will the examination be? I had the honor to serve in my city as one of the examiners for teachers for seven years, and some who passed the best examinations were the most signal failures. They could parse and diagram and analyze and answer all sorts of questions, and were signal failures as teachers. They could get a certificate for five years and could not get a school even in the townships. I think the power ought to be delegated to select in their own community the person they wish as health officer. (Applause.) What is the use of having a health board unless it is competent to select its own officer? If he can't act for the board, then you had better get another health officer; that is my opinion, and I think it is reasonable. Whether one man is more largely developed in literature and another in mathematics, or whether one man knows the names of a lot of bacteria—it is not the knowledge in one line or the other upon which depends the merits of a good health officer, but upon the summing up of the experience a man has in a general way.

We are only ten years old as a state meeting, and I think Dr. Probst is thoroughly honest in what he believes about the merit system, and we are just as good friends, though I differ from him. You who live in the rural districts then have to rely more on yourselves than those in the cities; you want the right to appoint your own health officer, and it seems to me the cities ought to have the right. The health officer, as the representative of the Board of Health, ought to pay obedience to the Board of Health; therefore, he ought to be appointed by the Board.

Dr. Buechner—I am very much opposed to this change in selecting health officers, for two reasons: First, is that politics would be back in it very soon; and second, is that I think this merit system is a humbug. I have known men who could tell you how every operation should be

performed, and tell you the names and everything else, and give them a knife in their hand, they couldn't do it. Now, as far as this merit system is concerned, we know a man may pass a very good examination and maybe be a pretty good man, and if he comes into practice will be a mighty poor man. I have seen that. If a man hasn't backbone, and cares if his neighbor curses him, he isn't fit for health officer. I was health officer in my town more than twenty years and could be yet. Many people say to me, "I would get mad with you if it was worth while," because I don't care a snap about it and I tell them so; if they are mad they can stay mad as long as they please. If a man hasn't that backbone he isn't any good for health officer, and I don't think an examination will tell that. And if the board of health appoints the man they know whether a man has got backbone better than if the Governor appoints him, and I am opposed to it. I am opposed to it because it takes away from the people the principle of self-government in local affairs. The people of the State of Ohio are quite as intelligent as the people in any other great state in this country of ours, and if they had an opportunity to vote on the question after due consideration, they would vote it to death. It means for people away off from your locality to govern your locality; that is what local self-government means in this affair. (Applause.)

Dr. George F. Leick, Cleveland—I want to endorse what has been said by the preceding speakers. This form of patriotism goes too far. If we cannot elect a board of health that is fit to elect the health officer, we had better have the whole shooting match elected from Columbus. If we have intelligence enough to elect a board of health, we should have intelligence enough to appoint the health officer. It is of very little importance whether he knows the difference between a streptococcus and a gonococcus; what he needs is backbone backed up by good horse sense. An ounce of good common sense is worth pounds of scientific knowledge in a health officer.

Dr. Daugherty—I want to emphasize the one point in regard to the county board of health. We organized two years ago in Crawford county, and we know every township is organized and reports promptly. I think if we have county organization we can see that the townships organize and make the proper reports.

Dr. True—Gentlemen, I fully agree with the last remarks that have been made in reference to this law, but it still seems to me there ought to be some center to the county organization. Now, within the last year we have had two cases in our county, Morgan county, of disease prevailing in townships, and the local board of health has sent me out to investigate. I went out and found they had scarlet fever. I hunted up the trustees and distributed some literature of the State Board and found them very ready to take the matter right up. All they wanted was simply to be informed and they were perfectly willing to take it in hand, and they did so and quarantined the cases and stopped it. Now, matters of that kind, it seems

to me, ought to be paid for by the county instead of by the local board in the township. They sent me out, thinking it would probably assist in protecting our town. The only change I see necessary in the law is to make some head to the county organization so that any diseases prevailing in the townships which are not being taken in hand can be attended to. I had no trouble in getting the co-operation of the trustees and quarantining there as well as in town.

Dr. C. A. Grahn, South Charleston—I wish to say I am in favor of a county health officer; but further than that I am in harmony with the speeches that have been made here relative to home rule. And I will move that it be the sense of this convention that we oppose the appointment of a committee to appoint health officers in cities of certain size, as mentioned.

Seconded—Question stated by the chair and remarks called for.

Dr. Kitzmiller—I offer an amendment to that, and we would favor the appointment of a county health officer in each county in the state.

Dr. Probst—Does this cut off all discussion? I would like to have a chance to reply to some remarks which have been made.

The President—It could come up on this question. The question has been moved and seconded and is before the house and is now open for remarks.

Dr. Probst—I do not rise to oppose the motion. I am glad that the paper has succeeded in bringing out this discussion. I think we should know what are the wishes of the health officers and boards of health in the state.

I hold in my hand a copy of the Municipal Code Bill. That published in the BULLETIN is only what refers to boards of health. This Commission was appointed and devoted two years to the study of municipal government. They sought information from all over the United States as well as abroad, and they have brought in a certain plan for the government of our cities, the principal object being to take the government of the cities out of the hands of politics. They have placed the health officer, as regards his selection, with the other officers of the city. The people elect a mayor and four men for the heads of the various departments. Every other city officer is to be appointed on the merit system. So you will see that this is not a blow, if you so regard it, aimed at either the health officer or the board of health. The purpose of the framers of the bill is to try to take municipal offices out of the hands of politicians. If you, gentlemen, could look over what I call "a list of health officers in the State of Ohio" and see how many times we have to revise it. There is scarcely a day that we do not have to rub out the name of one health officer and put in the name of some other, and these changes are very largely through political reasons. If, under the present system, we could keep such men as health officers as we have seen appear here quite regularly, we would certainly not want any change. But look around, and while

you will see a few familiar faces that have been known here for some years, they are exceptions. The office of health officer is coming to be more and more a political position. The health officer often elects or names the board of health. He puts his friends into council to vote for members of the board of health who will vote for him for health officer. It is in that way the health officer, in many instances, comes into office. When we get a good man, and he has had three or four years' experience and is growing valuable and the people want him there, some other man gets "a pull" and we have to erase a good name from our list. It is our hope that this municipal code bill will prevent such things happening. It does not say that he is to pass an examination in bacteriology, or the sciences, but the man who receives the highest grade in a practical examination shall be selected. Experience in the office would, and certainly should, count largely in the examination a man takes. In England the health officers of all cities of any size must hold a degree of Doctor of Public Health. To take that degree he must have a certain amount of work in universities which give such instruction. In addition to that he must have had a year's experience with some health officer. Then he is given his degree. My hope is to see the character of the work of the health officers of Ohio elevated and kept entirely out of politics; so that when we get good men we can keep them. If this bill will not accomplish that, let's help defeat it; but at the same time let us ask for such legislation as will accomplish this end.

Dr. Marchand—There is one feature, one objectionable feature to the code, I think, unless the provision is made as suggested by Dr. Probst, that there be a minimum fee fixed for the health officer. If that is left to the council, it can freeze out the best man or the poorest man or any man, by making such a "measly" fee that no man of any decency would take it.

A Member—The best man will make the most enemies and have his salary cut the first one.

A Member—I don't believe an officer makes only enemies. If he is a good officer and does his duty he makes friends as well as enemies. All law-abiding, good citizens will be his friends. I believe in upholding them and encouraging them to do their duty that way, and they will make the greatest number of friends.

Dr. Brown—I think the board of health has a good deal to do with the number of enemies he makes. If the board of health stands by him and tells the people he is only doing his duty and what he has to do, he will have no trouble. But if it tries to turn all the responsibility on the health officer when anything goes wrong, and says to him, "You are all right; go ahead," then he will have enemies. I think there should be a minimum price fixed for the health officer. If there isn't, one man can send in one price, and the Board can come to you and say so and so will take it for a certain amount; if you will do it for the same amount we will appoint you; if not, we will have to appoint him.

A Member—I want something that will divorce politics from boards of health. As far as the merit system is concerned, if it will do that, I am in favor of it.

The President—The motion is that it be the sense of this meeting that we oppose the governor appointing a commission to appoint health officers in cities of over three thousand population, and the amendment that we endorse the appointing of county health officers.

A further amendment is offered that “we approve the effort to divorce health boards from politics.”

Amendment accepted by Dr. Grahn of South Charleston as part of his motion; accepted by second (Dr. Kitzmiller) also.

The President—the motion is that we resolve that it is the sense of this convention of boards of health here assembled that they are opposed to the appointment by the Governor of a commission to appoint health officers in cities of over three thousand inhabitants; and the amendment,—Provided, however, that we are in favor of county health officers, and the amendment of Dr. Tenney of Cincinnati, that we approve of the efforts of the commission to divorce these things from politics.

Dr. Probst—This commission does not appoint the health officers; this commission examines everybody who comes before it and certifies to the standing of the applicants.

Dr. Marchand—The framer of the resolution would have improved, possibly, by saying “are opposed to the proposed municipal code in so far as it relates to the appointment of health officers.” That will cover it.

Dr. Buechner—If in order, I will offer a substitute, that it is the sense of this meeting that it doesn’t wish any change in the present way of appointing health officers in the community, just as in cities as in villages; let the people do it at home.

Dr. Howland—I move the motions be tabled indefinitely.

Seconded—Carried.

Dr. Buechner—I now move that it be the sense of this convention that they are in favor of leaving the mode of appointment of health officers as it is.

Seconded by Dr. True. Carried.

Dr. Marchand—I move that this resolution be presented to the committee appointed by the legislature on the municipal code.

Seconded—Carried.

Dr. Buechner—I move it be the sense of this meeting to recommend the appointment of county health officers in the state.

Seconded.

Dr. Leick—How are these county health officers to be appointed or elected?

Dr. Buechner—I would be willing to let the State Board of Health appoint them.

Dr. Daugherty—I think it is a good plan as in Crawford county to have a county organization and let them appoint them.

Dr. Kitzmiller—I think the legislature can fix that. I think the only way is to let it be filled by the people who live in the county.

Dr. Tenney, Cincinnati—I think these weighty matters ought to be referred to committees so there will be no confusion.

A Member—What do we want with a county health officer unless there is something for him to do?

Dr. Daugherty—I move it be the sense of this meeting that the different counties be requested to organize as county organizations.

The President—The question is before the house on the proposition of Dr. Buechner that the convention commit itself in favor of county health officers. All in favor of that say aye. It is not carried.

On motion it was decided to proceed with the next order on the program, viz., discussion of questions propounded by boards of health.

Dr. Buechner—Mr. President, I would like to get some advice to get out of a scrape. We have eight cases of smallpox in our town, and last week the board of health issued an order that by the first of February no child should be admitted to the public schools that has not been successfully vaccinated in five years, or had smallpox or varioloid. We have a number of families in the town who are very much opposed to vaccination—they publish a little paper, and I am satisfied they will not have their children vaccinated; and of course the children will be sent home and kept out of school. Now, the law says it will arrest you if you don't send your child to school. How are we to bring these two laws together and make them effective, both of them? I don't know whether any of you are placed in the same position, but I would like to know what the members think about it.

Dr. Laudick, Lima—That resolution passed by the Board of Health is inconsistent with the laws of Ohio. The Board of Education may do it, but the Board of Health cannot do it. The Board of Education may in time of epidemic compel them to stay away if not vaccinated.

Dr. Buechner—The attorney general of the state has decided that the Board of Health has the right to do it.

Dr. Tenney, Cincinnati—Was the committee of three appointed to confer with Dr. Hendley about the disinfecting of schools?

The President—I will appoint Dr. Tenney, Dr. Probst and Dr. Deuschle.

Dr. Tenney—I would like to read this bill and make a motion that the committee be authorized to include the consideration of this bill with the other. (Seconded.)

A BILL

To provide against the spread of contagious diseases through the use of barbers' tools.

SECTION 1. *Be it enacted by the General Assembly of Ohio:* That the owner, manager or keeper of any place where the business of barbering is conducted, shall disinfect, according to a method approved by the board of health of the city, village or township in which such business is conducted, every razor, clipper, shear, and brush immediately after each use thereof; and the board of health shall have authority to prohibit the use of sponges in such barbering business.

SEC. 2. Any such owner, manager or keeper, who shall neglect or fail to comply with the regulations of the board of health, authorized by the preceding section shall be deemed guilty of a misdemeanor, and shall on conviction thereof be fined not more than twenty-five (\$25.00) dollars and not less than five (\$5.00) dollars.

SEC. 3. This act shall take effect and be in force from and after its passage.

Dr. Tenney—I do not claim that this is perfect, but I claim some such measure ought to be put on the statute books, and I want this committee to have authority to confer with Dr. Hendley on this matter and recommend a bill.

Resolution adopted.

Dr. Buechner—I would like if Dr. Probst would express an opinion on my question I asked.

Dr. Probst—I will just say that the question was presented to the attorney general some three or four months ago, the question of compulsory vaccination. His opinion was that the Board of Health, when small-pox is actually present in a community and threatens to become epidemic, has the right to enforce the vaccination of school children or any other class of special danger to the community.

Dr. Buechner—I claim that law and the truant law conflict. If the people keep their children at home because they don't want them vaccinated the truant officer says, "I will arrest you if you don't send your children to school."

Dr. Probst—The attorney general (a former one) and the school commissioner are of the opinion that the truant law does not conflict with the vaccination law. He took the ground that the Board of Health has the right to make certain laws to protect the public health and that a rule requiring vaccination of school children did not excuse a man from the truant law; therefore, if the Board of Health made the rule that school children must be vaccinated before going to school and the father refused to send the children to school because he did not want them vaccinated, you can prosecute the father.

Thereupon, on motion, meeting adjourned.

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